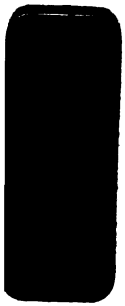
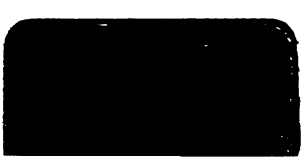
INTRODUCTORY PHYSIOLOGY AND HYGIENE

CONN & SHEPHERD

THE PUBLIC HEALTH AND THE YOUNG CITIZEN

SILVER, BURDETT AND COMPANY





INTRODUCTORY

PHYSIOLOGY AND HYGIENE

FOR USE IN INTERMEDIATE GRADES

BY

H. W. CONN, PH.D.

PROFESSOR OF BIOLOGY IN WESLEYAN UNIVERSITY, AND AUTHOR OF "ELEMENTARY PHYSIOLOGY AND HYGIENE"

SPECIAL EDITION

INCLUDING CHAPTERS TREATING OF THE PUBLIC HEALTH AND THE YOUNG CITIZEN

BY

W. A. SHEPHERD, M.D.

DIRECTOR OF MICROSCOPIC LABORATORIES IN THE MEDICAL COLLEGE OF VIRGINIA

SILVER, BURDETT AND COMPANY

NEW YORK BOSTON CHICAGO

THE CONN SERIES OF PHYSIOLOGIES.

For Intermediate Grades.

INTRODUCTORY PHYSIOLOGY AND HYGIENE.
By H. W. Conn, Ph.D. *Illustrated.* 211 pp.

For Grammar and Higher Grades.

ELEMENTARY PHYSIOLOGY AND HYGIENE.
By the same author. *Illustrated* in color and in black and white. 334 pp.

For High School Grades

ADVANCED PHYSIOLOGY AND HYGIENE.
By H. W. Conn, Ph.D., and R. A. Budington, A.M.
Illustrated. 419 pp.

FIVE PROGRESSIVE POINTS IN THE SERIES.

Emphasis is laid upon Practical Phases.
The Series is Modern in Plan and Execution.
Class-room Needs are Well Met.
The Interest of the Series is Strong and Real.
The Illustrations are Pertinent and Helpful.

PREFACE

THIS introductory text-book on physiology and hygiene is, as its title indicates, intended to precede the author's more advanced work on the same subject. The demand for a beginner's book, to be used in intermediate grades, has been urgent, owing to the steadily increasing recognition, on the part of both parents and teachers, of the necessity of instilling in children, even when very young, an appreciation of the laws of health.

The aim of this little book is not only to instruct, but to interest, its readers by presenting the subject in simple language and by using only such comparisons as are familiar to the average child. Special emphasis has been laid on the value of good food, of out-of-door exercise, of the formation of regular habits, and of right living from day to day.

As in the elementary book, the effect of alcohol and narcotics is treated in direct connection with the various organs and functions of the body concerned.

The illustrations have been carefully selected with a view toward helping pupils to understand the text and toward stimulating them to healthful activity.

The author is especially indebted to the Young Men's Christian Association of New York City for their courtesy in allowing the reproduction of several illustrations of their outdoor games and sports.

CONTENTS

Introductory Physiology and Hygiene

The Public Health and the Young Citizen

INTRODUCTORY PHYSIOLOGY AND HYGIENE

CHAPTER I

WHY WE NEED TO KNOW ABOUT OUR BODIES

The Steam Engine and How It Moves. — A railroad engine stood attached to a train in the train-yard. It was a wonderful piece of machinery. It had a great boiler and driving wheels as high as a man's head. Yet all its wheels could not make the engine move itself, so there it stood, as helpless as a lump of clay.

Two men came up — the fireman and the engineer. The fireman made a fire in the furnace of the engine and fed it with fuel. He also cleaned and oiled the machinery. The water in the boiler grew hot, and part of it became steam. When steam enough had formed, the engineer opened the throttle and "turned the steam on." Through the force of the steam the engine started smoothly and swiftly down the track.

The engine may draw its train many hundred miles every day. To do this the machinery must

be kept clean and well oiled. The fireman must see that there is plenty of water in the boiler and plenty of coal or other fuel in the fire box. There must be a skillful engineer, who knows every part of his engine, as you know your letters, and who can run his engine so that the passengers on the train are safe.

The Body Engine and How It Works. — The human body also is a wonderful engine. Its machin-

A Locomotive at Work

ery is far more delicate than that in a locomotive. Every one must be the engineer of his own body, and its fireman also. If we keep our body engines in good order, they will do their work well. If we let them get out of order, they cannot work as they should, and we may suffer *pain.* A person whose body is out of order is *ill.*

An engineer does not know how to run an engine without learning about its machinery and how the machinery works. Likewise, if we wish to keep well and strong, we should learn about the body engine and how its machinery works. The study of the body and its working is called *Physiology.*

The engineer, as we have seen, must not only understand his engine, but learn how to keep it in perfect order. If he does not, the machinery may become so clogged and broken that it cannot work. We, too, must learn how to care properly for our bodies. The study of the way to take care of the body is called *Hygiene.*

What is going on in our Bodies. Food and its Uses. — Every little while the railroad engine must have more fuel. If the fireman does not frequently give the furnace the fuel it needs, the engineer will find that his locomotive will go more and more slowly and will finally come to a stop.

Our bodies need something that corresponds to fuel. Every day they let us know that there is something they need by making us feel hungry.

The engine must have proper fuel to burn or it cannot work. Our bodies must have proper food or we cannot be well and do *our* work.

If we treat our bodies well, we may be healthy all our lives. The engineer is proud of having his engine in the best possible order. The parts of the machinery must move easily; the metal must shine, and no unsightly dirt or dust must mar the appearance of his beautiful locomotive. We, too, should be proud to keep our bodies beautiful, by living so that they may be pure, clean, and healthy, without and within.

QUESTIONS

1. What does the engine need to make it move?
2. What will happen if the engine has no water or coal?
3. Who guides the engine?
4. What is the engine that you must guide?
5. What will happen to the body engine if it is not guided well?
6. What would you have to do before you could guide a locomotive?
7. What must you do to be able to guide your body engine?
8. What is the study by which we learn how to care for our bodies?
9. What is the study by which we learn about the different parts of the body and how they work?

CHAPTER II

WHY WE NEED FOOD

THE baby cries for its breakfast. The dog barks for his bone. A cat will watch at a mouse-hole for hours at a time. The robin searches the lawn for worms in the early morning or pecks at the cherries in the orchard. The plants take food from the soil in which they grow. Everything that lives must have food — the kind of food it needs — or it will die.

Three times a day, perhaps oftener, we are hungry. This means, as we have already seen, that the body is calling for food to supply its needs.

You came into the world a tiny baby. Your fingers were so small that you could not even hold a rattle. Your feet were so weak that you could not take a step. Now you are tall and strong. You can lift a flatiron or a heavy stone, and your feet and legs carry you wherever you wish to go. Some day you expect to be larger still, as large as your father or your mother.

Why we need Building-food. — It is the food we eat that makes our bodies grow large and strong. Children must have a large amount of food to make their bodies grow. Even grown-up people must eat some building-food, for, though they are not getting taller, parts of the skin, the muscles, the bones, and indeed all parts of the body wear out. You have, perhaps, seen bits of loose skin hanging from your hand. This was worn-out skin thrown off by the new skin which grew underneath. When our clothing wears out, it has to be mended or repaired. When parts of our bodies wear out, they also must be repaired. So food that builds up our bodies is also needed to repair them when they are wearing out.

Why we need Food for Power. — When you lift your arm, the muscles do the lifting. It is the food we eat every day that gives them the power to move. A locomotive may stand still in the engine house all day long and need no coal while it is there. But our bodies are never entirely still, so they need to be fed every day, whether we are working or resting. They are really always moving. Even when we are asleep we

are breathing, and the heart is always beating to pump the blood through the body. Both the breathing and the beating take power.

Boys work and play out of doors nearly all day, except when they are in school. Girls take

"Boys and Girls come out to Play."

less exercise. They spend more time in the house, playing with dolls or helping mother. Which needs more food, a boy or a girl? Why?

Why we need Food for Warmth. — Besides food for growth and repair and food for power, the body needs also food for warmth.

If, with your bare hand, you happen to pick up a stone that has been lying on the ground on a wintry day, you will find it very cold. You yourself may have been exposed to the same wintry weather, but, if you have been playing, your body is really just about as warm as when you are in the house. A stone becomes cold if the air is cold, because there is nothing inside it to keep it warm. Our bodies, on the other hand, are always warm. Let us see why this is.

To keep a house warm, we burn coal in the stove or furnace. Part of the food we eat is burned in the body to keep us warm. And just as a house needs more fuel in winter to keep it warm, so, in order to keep our bodies warm, we need to eat more nourishing food in winter than in summer. The burning of this food keeps us warm even when we are out in the cold air.

We need food, then, for three purposes — to make our bodies grow, to keep our muscles strong and give them power to move, and to furnish warmth for our bodies.

Building-foods. — Is there a baby at your house? If so, you know how fast it grows. You can see

a change almost from day to day, yet the baby eats nothing but milk until it is several months old. Milk makes babies grow, furnishes their muscles with power, and keeps their bodies warm at the same time. Little babies need only milk for building-food, but by the time they are old enough to walk, they ought to have other things as well.

THE OAT PLANT

Very likely mother begins by giving baby a little oatmeal with his milk. Oatmeal is one of the best sorts of foods for growth. All foods, like oatmeal or cracked wheat — cereals, we call them, — are building-foods. They also give us power and keep us warm.

By the time baby is a year old, he can eat some bread and butter. The bread helps him to get strong and stout; the bread and butter both help to keep him warm.

Lean meat, milk, beans, and peas, all are good building foods, that is, they help us to grow. They all give power to the muscles, too, and all have warming qualities.

Food for Power and Warmth. — We eat some kinds of food that do not build our bodies at all. They do nothing but give us power and keep us warm. Sugar is one of these. If we should eat nothing but candy or sugar, it would never make us grow one inch taller, nor would it even keep us alive. We eat sugar to give our muscles power to move and to keep us warm. Fat meat, cream, or any food that contains oil or starch also gives us power and warmth. Bread, potatoes and nearly all vegetables are partly starch, and, when cooked, starch is a good food to furnish power and keep us warm.

Fat is the best of warming food and likewise furnishes us with power for our muscles. We need very little fat in summer because our bodies would get too warm, and we should suffer with the heat. In winter we should eat more fat than in summer so that our bodies will not suffer from the cold. The children who live in the far-

away north eat a great deal of fat. An Eskimo boy or girl would rather eat a tallow candle as a treat than a box of the nicest candy.

So, if we should go on through the whole list of foods, we should find that each does something for our bodies. We learn in *Physiology* just what kinds of food it is best for us to eat to build our bodies, and what kinds are best to give us power, and to keep us warm.

QUESTIONS

1. How do we know when a dog needs food? A cat?
2. How do we know when we need food?
3. For what three purposes do we need food?
4. Why must our bodies have food several times a day?
5. When do you eat more, in summer or in winter? Why?
6. What can you eat to make you grow?
7. What can you eat that will give your muscles power and keep you warm?

WRITTEN LESSON

1. Make a list of ten kinds of food you like to eat in summer. Are they the best foods for you to eat in hot weather?
2. Make a list of ten different kinds of food you like to eat in winter. Are they the best foods for you to eat in cold weather?

CHAPTER III

WHAT TO EAT

If you should sit down to a table every day for a week and have nothing given you but oatmeal, you would think you were badly treated. You might eat enough of it to keep you from starving, but you would soon become so tired of it that you would probably lose all desire for food.

The desire for food is called the *appetite.* To keep a healthy appetite, we must have not only plenty of foods for building the body, for giving it power and for keeping it warm, but we must have a variety of each kind of food.

Foods that are Good for Us. — We should have for every meal some food to furnish building material and some to supply power and heat. Children should eat bread and butter, milk, a little meat, and cereals. Milk builds and repairs our bodies and also gives them power and warmth. Cereals, as you already know, are also a good building-food. The cream of the milk, the butter that is

eaten on the bread, and the meat will supply us with fat. What does fat do for our bodies?

We should also eat some sugar to give us power and keep us warm. Candies and cakes will supply the needed sweet. Too much sweet takes away our appetite or desire for other food that our bodies need to make them grow. Candy is a perfectly proper food if it is eaten moderately at mealtime. It is not a good habit to eat any sweet between meals.

Breakfast, Dinner, and Supper. — Have you ever thought why we have several different kinds of food at a single meal? If we should eat only building-foods, our appetite would soon grow tired of them and demand other kinds of food also — that is, foods for power and warmth. So, for breakfast, we may have oatmeal or some other cereal, milk, eggs, bread, and fruit. For dinner we have something more substantial, like soup, meat, potatoes, or other vegetables, and afterwards a sweet dessert. The meat, potatoes, and soup give us building-food as well as power and warmth. The dessert furnishes us with power and warmth, but with less building-food.

It is better for children to have dinner at noon than at night. Then there is proper time to digest their food. If a hearty meal is eaten at night, it would be better for children not to go to bed for an hour after eating. Then they will have a

SUPPER TIME

chance to exercise and will sleep better for it.

A good supper for a child is bread and butter, milk, stewed fruit, and plain cake.

School Luncheons. — A school luncheon should be very simple. If the luncheon is to be eaten at

recess, take a slice of bread and butter and some fruit. For noon luncheon, sandwiches are good, and plain cake.

Sandwiches may be made in as many ways as there are school days in a month. Peanut butter, sardines, chopped ham and slices of cold meat, all make a good filling. Wrap the sandwiches in one piece of paraffin or waxed paper, the cake in another, the fruit in still another. A school luncheon tastes better when it is daintily put up.

QUESTIONS

1. What would happen if you had nothing to eat but oatmeal?
2. What is appetite?
3. What can you eat that will furnish your body with building food? With power?
4. What kind of food furnishes you with the most warmth?
5. Why do we have a variety of foods at every meal?
6. Is it better for children to have dinner at night or at noon?

WRITTEN LESSON

1. Write a list of foods that would make a good, nourishing breakfast.
2. Write another, telling what foods would make a good dinner.
3. Write a third list, telling what you had for supper last night.

CHAPTER IV

KINDS OF FOODS

The Three Kingdoms. — Probably many of you have played the game of "Twenty Questions." If you have, you will remember that the first question is, "Does it belong to the animal, mineral, or vegetable kingdom?"

Everything in the world must belong to one of these three classes or kingdoms. Let us see to which of these kingdoms certain different kinds of food belong.

TABLE OF PRINCIPAL FOODS

Animal	*Mineral*	*Vegetable*
Milk	Salt	Cereals
Butter	Lime	Vegetables
Eggs	Soda	Fruit
Flesh	Iron	Nuts
	Potash	Sugar
		Spices
		Honey

By *flesh* we mean meat, fowl or game, and fish. The best kinds of meat for us to eat are *beef* and *mutton; chicken* also is very good.

We all need *lime* to make bones and to keep them hard and strong. All the lime our bodies need we may get from cereals and in bread and milk. *Soda, potash,* and *iron* are all necessary for our health and are contained in several of the different kinds of food that we eat.

"What is it that spoils the potato when it is left out?" is a very old question. The answer is "Salt." We like sugar with some kinds of food, pepper with others, but salt is something that we want with all kinds of cooked foods. We sometimes sprinkle a little salt even upon nuts. Salt does not furnish us with food for growth, power, or warmth, and yet our bodies need to have a little of it in order to be healthy.

The most nourishing vegetables are *beans* and *peas. Potatoes* contain a great deal of starch, as you have already learned, and are therefore a good food for furnishing power and warmth, but not growth.

Fruits should be eaten only when they are *ripe*, unless they are stewed.

Nuts are a nourishing food, if eaten slowly and chewed *very fine.* Honey, too, is good for us in small quantities, but *spices* are often very harmful. They may make food taste better, but they should not be eaten too freely.

Perhaps, when you are studying the table of foods, you will wonder why bread and jelly and cake, and many other foods, are not given. Study the table very carefully again, and this time you will notice that only *raw* foods are given.

Now bread, which is a cooked food, contains flour and milk and a little salt and sugar. The flour, which is made from wheat or grain, and the sugar are *vegetable* products. The milk is an *animal* product and the salt is a *mineral* product. So bread belongs to all three kingdoms.

QUESTIONS

1. What are the names of the three kingdoms?
2. Name the principal animal foods. The principal mineral foods. The principal vegetable foods.
3. What do we mean by flesh?
4. What parts of our bodies need lime? Why?
5. Which mineral food is the most needed to keep our bodies healthy?
6. To what kingdoms does candy belong? Cake? Jelly?

CHAPTER V

WHY WE NEED DRINK

THE blood flows through our bodies constantly. The blood is a liquid and contains a large amount of water. So we must drink enough water to give the blood all it needs.

ONE SOURCE OF DRINKING WATER

On a warm day our hands become moist, and sometimes little drops of moisture stand out on our faces. This moisture, called *sweat*, is moisture that comes from inside the body through the skin. Water is passing out through little openings in the skin all the time; but we see it only when we are very warm, for then it comes faster than usual. We must drink water then to replace the moisture which our bodies send out through the skin.

The bones and muscles of our bodies also need water. In fact, about three fourths of the weight of the human body is water. Much of the water that we need we get in the different foods we eat. Some foods are cooked with water, and other foods have water in them. The juice of fruit is water, and so is the juice of meat. Milk also contains a great deal of water. But our bodies need more water than they can get through the food we eat. We must also drink water. The desire for water we call *thirst.*

QUESTIONS

1. Why do our bodies need water?
2. What is sweat?
3. How much do you weigh? How much of the weight of your body is water?
4. If there were no water in your body, how much would you weigh?
5. Do our bodies get water in other ways than through the liquids which we drink?
6. What is thirst?

CHAPTER VI

WHAT TO DRINK

What is Best to Drink. — Water is the only drink that will really quench thirst. We speak of drinking coffee, tea, or milk, but these are all made of water with something in it to give it a flavor. Nothing but water takes away our thirst. Pure water is the finest drink in the world. It is more refreshing than anything else, and more healthful. Cool water is better for us than very cold water. If you drink ice-water, take only a sip at a time and hold it in the mouth a few seconds before swallowing it.

The best drinking water comes from mountain springs and deep wells. Water from shallow wells may be good, unless the well is very near a house. Then it is often made impure by drainage matter from the house, and even if it looks clear, it is not safe to drink unless boiled. Water from carefully protected reservoirs is usually good. Water from rivers should be boiled for drinking purposes.

Many people drink too little water. Grown-up persons should drink nearly two quarts a day. Children who are running about and exercising constantly, require nearly as much. We need much more in summer than in winter. Can you think of any reason for this?

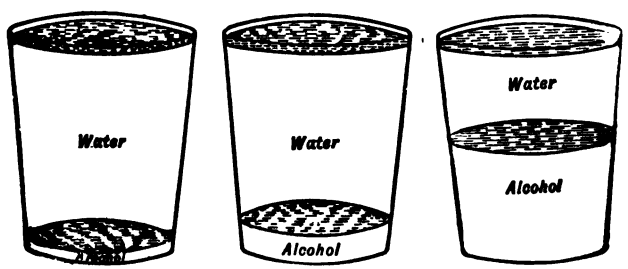
You need never be afraid of drinking too much good water unless you are very warm, and not then unless the water is very cold. You may drink it moderately at mealtimes and between meals, whenever you are thirsty.

Grown-up people often drink water with a little coffee or tea in it, because they like the taste. Both coffee and tea make children excitable. Cool water and milk are all the drinks that young people need with their meals. Soda water is water with a kind of gas in it to give it a biting taste and a little syrup to give it a flavor. Soda water is not harmful if you do not take too much of it.

What is Injurious to Drink. — Sometimes a substance called *alcohol* is added to water to make drinks. Pure alcohol is good for some purposes, such as rubbing on a sprained ankle or wrist, but

it is injurious as a drink. Very likely you have seen alcohol used in a lamp to heat milk, or in a chafing dish. If so, you know that alcohol burns well. Any liquid with alcohol in it is harmful to drink.

Sometimes when a can of preserves is opened, we find that it is not good. It has *fermented*,



Showing the proportion of alcohol and water in beer, wine, and whisky

because the can was not quite tightly closed, — that is, some little plants, called *yeast*, got into the can through the crack and turned part of the juice to alcohol. Some drinks that have alcohol in them, like wines, are made from fruit juice by leaving it open to the air, so that the yeast floating in the air gets into the juice. Sometimes yeast, very much like the yeast used in making

bread, is placed in the fruit juice by the person who makes the drink, as in making beer.

Some drinks that contain alcohol are beers, ales, wines, rum, gin, whisky and brandy. Beer contains the smallest amount of alcohol; rum, whisky, gin and brandy a larger amount. The person who begins by taking only a little alcohol is likely soon to want more. He may form a drink habit that will ruin his life; alcohol thus becomes a poison to him. So one should never drink even the mildest liquors.

QUESTIONS

1. What is the most healthful drink of all? Why?
2. Where does the best drinking water come from?
3. What should be done to river water before we drink it?
4. Why should a well not be placed very near a house?
5. About how much water should children drink every day?
6. What other drinks are good for you to drink besides water?
7. For what may pure alcohol be used?
8. For what should alcohol *not* be used?
9. What is meant by fermenting?
10. What drinks contain alcohol?
11. What is the effect of drinking a little alcohol?

CHAPTER VII

COOKING

How Cooking Began.—There is an old story, said to have come from the Chinese, that tells how the art of roasting was discovered. Charles Lamb, an English writer, says that one morning the swineherd, Ho-ti, went to the woods, leaving his cottage in the care of his son, Bo-bo. The boy, being fond of playing with fire, let some sparks fall by accident into a bundle of straw. The fire could not be checked, and the house was burned to the ground. What was worse, with the cottage perished nine little pigs.

While Bo-bo was thinking what he should say to his father, an odor came to his nostrils unlike anything he had ever smelled before. He stooped down to see if there were any sign of life in the pigs, and burned his fingers. To cool them, he put them to his mouth, and "for the first time in his life (in the world's life, indeed), he tasted—crackling!" "Crackling" is the name Charles Lamb gives to roasted pork.

At length the boy realized that it was the pig that smelled so savory and the pig that tasted so delicious. He fell to tearing up whole handfuls of the flesh, and was cramming it down his throat, when his father came and began to beat the young rogue across his shoulders. Bo-bo heeded the blows no more than if they had been flies. When he had fairly made an end of the pig he was eating, he cried: "Oh, father, the pig, the pig! Do taste how nice the burnt pig is!"

Father and son sat down, and never left off until they had eaten all that remained of the nine pigs. From that day Ho-ti's cottage was always burning down. Soon other houses in the neighborhood began to burn. Fuel and pigs became enormously costly all over the district. Finally, somebody discovered that the flesh of a pig or of any other animal might be roasted without burning down a whole house. And that, so the story goes, was how cooking began.

Reasons for Cooking. — Although this is only a made-up story, it will help you to guess the principal reason why we cook food. It is because we like the taste better. There is, however, another

reason. You would, for instance, find it very difficult to eat raw, dried corn, and, even if you chewed it very fine, you would find it very difficult also to digest it. But put the corn into a popper and shake it over a hot fire, and what happens? One by one the kernels begin to pop. Instead of being heavy and solid, they swell to twice or three times their former size, and are light, crisp, and easy to digest, — that is, they can be made into a liquid after they enter the body. Cooking swells starchy foods and thus makes them more digestible. We do eat some foods raw, such as fruits, certain vegetables, and milk, but most foods are improved by cooking.

Different Ways of Cooking. — If some one should ask you in how many ways your mother could cook food, you would probably answer, "In many different ways." You would be thinking of the different articles that she could make, such as bread, pies, and cakes. But whatever she makes, she can cook in only four ways. She can *boil*, *bake* (or *roast*), *broil*, and *fry* food. The four ways of cooking are, then, boiling, baking, broiling, and frying.

If we heat an article of food by putting it into hot water, we *boil* it. If we place the food in hot air, as in an oven, we call it *baking* or *roasting*. If we place the food directly over or under a hot fire, without putting it into a pan or dish of any kind, we *broil* it. This is the best way to cook beefsteak.

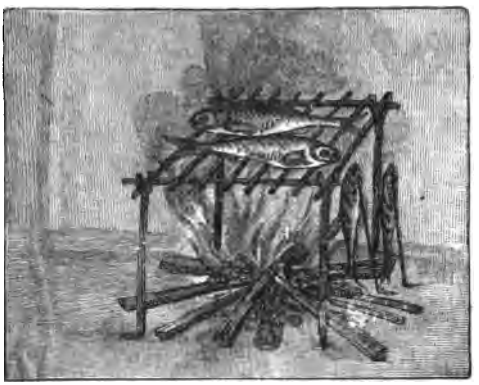
COOKING IN COLONIAL DAYS

Showing the process of boiling over the fire and of baking in an oven

Sometimes food is cooked in hot lard or fat. We call this *frying*. It is not a very good way of cooking, because the food soaks up fat. Fried doughnuts are always so well soaked with fat that they are heavy, and therefore not very healthful.

The Effects of Cooking. — All meats should be thoroughly cooked, not only to make them taste better, but to make them safe to eat. Sometimes raw meat has tiny living animals buried in the muscles. If we eat the meat raw, these

little animals may grow in the human body and cause severe illness. Milk also is safer to drink if it is first heated boiling hot, because it contains little living plants, called *bacteria*. These are usually harmless; but sometimes there are dangerous kinds, which, if we swallow them alive, may cause illness. If milk is taken from the fire before it has really boiled, the taste is almost the same as that of cold milk.



INDIAN METHOD OF BROILING

If roast meat is well browned on the outside, a sort of coat or covering for the meat is formed by the heat, and the meat inside is thus kept soft and juicy. It is very much the same with bread. We bake it in an oven because the heat forms a crust and keeps the inside soft.

All grains are largely starch. Although we cannot see the change as plainly with all grain

foods as we can with popped corn, cooking softens and swells the starch in them all, making them easier to digest than they would be if eaten raw. This is true, also, of peas and beans. You would hardly like to eat dry beans raw, they are so hard; yet cooked, they are soft and nourishing.

Cooking hardens the white of eggs; for this reason they are more digestible when soft boiled.

Almost all cooked vegetables are more healthful for us than those we eat raw. Potatoes contain a great many little grains or particles of starch. In the *raw* potato these little starch grains are very hard, but cooking swells and softens them. When we swallow this cooked starch it is made into sugar, and is then digested. Rice also contains a great deal of starch and should be thoroughly cooked. Beans and peas should be cooked a long time to make them soft. They should also be carefully chewed.

STARCH GRAINS
As seen through a microscope

The vegetables that are eaten raw — cucumbers, radishes, and celery — are not so healthful

as the vegetables we cook, and are eaten as a relish, not as a food. Most of them are hard and contain little nourishment.

Ripe fruits are good for us; but all unripe fruits, such as green apples, should be cooked.

The Value of Good Cooking. — A dear old German lady in New York was asked how she kept her husband and children so happy and contented in their very plain little home. "It is because I know how to cook," she replied. "My children know that every time they sit down to a meal, they will have something they will like to eat. My husband enjoys his dinner; we are all happy at meal-times, and the food does us good. That makes us happy all day."

Food well cooked and nicely served tempts us to eat whether we are hungry or not. If we are cheerful and glad when we eat, and do not try to hurry, our food will be more likely to digest properly.

Every girl, and every boy, too, should learn how to cook. If you have never tried to cook anything, ask your mother to begin to teach you by letting you prepare something simple, like

oatmeal. When you can do that well, try toasting bread, boiling eggs, and baking potatoes. The person who can make good bread or cake is a skilful cook.

QUESTIONS

1. Why do we cook food?
2. In how many ways can food be cooked?
3. How is food cooked by boiling?
4. How is food cooked by baking or roasting?
5. What is broiling?
6. Why is frying a poor way of cooking food?
7. Why should meat be thoroughly cooked?
8. What does cooking do to starchy food?
9. Why are raw vegetables less healthful than cooked vegetables? Why are some vegetables eaten raw?
10. What can you cook?

WRITTEN LESSON

1. Write a list of all the kinds of food you can think of that are improved by cooking.
2. Write them in lists, — the meat in one list, the grains or cereals in another, the fruits and vegetables in a third.
3. Write a list of five kinds of food that are improved by baking or roasting. Five kinds of food that are cooked by boiling. Three kinds of food that are sometimes eaten cooked and sometimes uncooked.

CHAPTER VIII

FOOD HABITS

How Much to Eat. — The only way by which we can tell how much we ought to eat at any one time is to obey our appetite. As a general rule, it is wise to stop eating when you think you can eat no more substantial food. If you wish to finish a meal with a cooky, leave room for it. Stop eating other things before your hunger is quite satisfied.

Children often sit down to the table and, after they have seen what has been provided, decide that they do not care for anything. They do not refuse to eat because they are ill — not at all. They are hungry, but they just sit, very likely with sulky instead of happy faces, and refuse to eat wholesome food simply because they do not like the taste! Can you think of anything much sillier? If we try, we can learn to eat almost any kind of wholesome food, and certainly we shall be better and stronger men and women for so doing.

A young child should not eat so much food as a man. A person who is active or busy all day, either in an office or out of doors, needs a great deal of nourishing food. An invalid, or a person who has even a slight illness, may eat less than one who is perfectly well. The amount and kind of food we eat should be adapted to the climate in which we live, to the season of the year, to our age, our health, and our occupation.

When to Eat. — People in America usually have three meals a day — breakfast in the morning, lunch or dinner at noon, and supper or dinner at night. It is best to eat at mealtimes only. If you get hungry between morning and noon, or between noon and night, eat a lunch if you wish, but eat only one and take it at *the same time every day.*

You can easily see why it is not wise to be constantly eating candy, munching apples, or even chewing gum. The stomach needs time for rest as much as do the other parts of our bodies, and the rest periods must be at regular times.

A FEW GOOD RULES ABOUT EATING

1. *Eat slowly, chewing your food well.*
2. *Eat at regular times every day.*
3. *Eat enough to satisfy your hunger.*
4. *Drink plenty of water, but little at meal times.*

Remember that as water is the only drink that satisfies thirst, it is better to take this clear than with any substance in it. Water that contains alcohol is especially injurious to the stomach. When the stomach has been injured, it cannot do its work — that is, it cannot take care of the food you eat, and you may become ill.

Have you ever thought why the law does not allow alcoholic drinks or tobacco to be sold to boys and girls? If you do not know, ask your father to tell you.

QUESTIONS

1. When should we stop eating?
2. What has climate to do with the kind of food we eat?
3. Name some of the kinds of food you do not like to eat.
4. Are they good, nourishing foods?
5. Could you learn to like them?
6. Give four good rules about eating and drinking.

CHAPTER IX

HOW THE FOOD GETS INTO THE BODY

PUT a lump of sugar into a tumbler of water and leave it for ten minutes. Can you find the sugar now? Is the sugar still there? Drink a bit of the water and decide from the taste whether the sugar is there or not. We say that the sugar has been dissolved in the water. That is, it has been so mixed with the water that one cannot see it, and it appears as a liquid instead of a solid.

Food is carried through the body by the blood. The blood takes the food to the brain, the muscles, and the bones. But the blood cannot take pieces of solid meat or bread through the tiny blood vessels. The food must, therefore, be dissolved, or made a liquid, before it can get into the blood. The changing of foods into such a form that they may be dissolved and carried to the various parts of the body by the blood, is called *digestion.*

The Mouth. — Look at your mouth in a mirror. You will see that it is hollow, like a small cave. In it are *teeth* and a *tongue.* Behind the tongue

you can see an opening. The mouth helps to digest the food, and this is the way it is done.

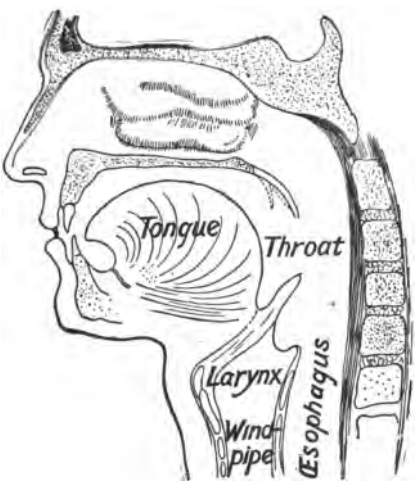
In the first place, bite off a piece of bread with the teeth and chew it into fine bits. This helps the stomach to dissolve or digest the bread better, for the same reason that powdered sugar dissolves more quickly than a solid lump of sugar.

The tongue, by moving the food around, also helps in chewing. Look at your tongue in a mirror once more. Do you see the little bunches on it? In some of these are bodies called *taste buds.* They cannot be seen without a microscope. They tell us whether the food that we take into our mouths tastes pleasant or not.

Saliva or What the Mouth Secretes. — There is something else in the mouth that helps us to digest food. As we chew the mouthful of bread, it is mixed with the moisture of the mouth. This moisture is called *saliva.* It comes from little pockets or glands, called *salivary glands.* We cannot swallow food dry. A liquid, such as soup, we can swallow as soon as it is taken into the mouth, but if we try to swallow a piece of cracker unmoistened by the saliva, we are likely

to be choked by it. The saliva moistens the food so that we may swallow it and turns part of the starch in our food to sugar. This also dissolves, so that when the starchy food reaches the stomach it is already partly digested.

The Œsophagus. — After the food is chewed and moistened by the saliva, the tongue pushes it back into the throat. In the front part of the throat is a tube called the *windpipe*, through which the air that you breathe passes into the body. Behind the windpipe is a second tube called the *œsophagus* (ē-sof'-a-gus). This tube connects the mouth and the stomach. When we swallow, the food passes down the œsophagus into the stomach. If you try to talk or laugh when you are about to swallow, some of the food will probably get into the windpipe, and you will



A Section through the Head
Showing the relation of mouth, throat, etc.

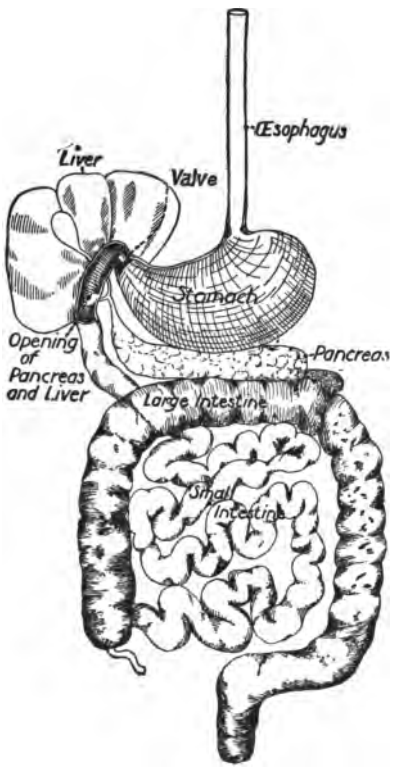
choke. This is what happens when you "swallow the wrong way."

Over the windpipe is a little lid, or cover, which closes the opening to the windpipe and allows the food to pass over into the œsophagus. This little lid is closed or shut down over the windpipe only when we swallow.

The Stomach. — The stomach is a kind of bag at the end of the œsophagus. It is on the left side of the body. The stomach of a grown-up person is large enough to hold about three pints of food at a time. Between the œsophagus and the stomach is a little valve that keeps the food from going back into the œsophagus after it is swallowed. At the lower end of the stomach is another little valve that keeps the food from leaving the stomach too soon.

The food that has been chewed and swallowed enters the stomach directly from the œsophagus. In fact, it takes only a few seconds. Immediately the stomach begins its part in the digestive work. The muscles of the stomach move slowly, pushing the food about, much as cream is moved about in a churn to make butter.

Gastric Juice or What the Stomach Secretes. — The stomach has thousands of glands in its walls, corresponding to the salivary glands of the mouth. Each gland is shaped somewhat like a little bottle with its mouth opening into the stomach, and each pours a liquid out of its mouth into the stomach. The liquid is a sour substance known as *gastric juice.* The food in the stomach starts these thousands of gastric glands into action, and gastric juice is thus poured upon and mixed with the food as it moves about. The gastric juice digests or dissolves a large part of the food. It turns the food into a soft, pulpy mass.



THE DIGESTIVE ORGANS

The Small Intestine. — The food passes from the stomach into the upper end of the small intestine. This is a tube about twenty-five feet long and from one to two inches across. It is coiled up inside the body. In the intestine, as well as in the mouth and the stomach, there are also juices which soften and digest the food still more. By their actions in the intestine, the food is changed into a liquid of a whitish color.

When the food is all digested and is in the form of a liquid, it must get into the blood in order to be sent to the parts of the body where it is needed. It can then help the heart to beat, and the arms and legs to move. How does it get into the blood? The walls of the intestine are covered with little projections, like tiny fingers, standing on the surface. Each of these is very small like one of the tiny threads of a piece of velvet.

There are about four millions of these little fingers on the walls of the intestine. They are full of the tiniest blood vessels you can imagine. As the digested food passes slowly along the intestine, it enters into these blood vessels and mixes with

the blood that is flowing through. The blood then flows around to the different parts of the body, carrying this digested food with it.

The Liver and What it Secretes. — You have probably seen an ox's or a calf's liver at the meat market. If you have not, ask the butcher to show you one. The liver in our body is much like that of an ox, except that it is smaller. The liver is dark red and is the largest organ in the body. In a grown person the liver weighs about four pounds. Its place is on the right side, a little above the stomach. It secretes a fluid or juice called *bile*. When food is being digested, the bile passes through a tube into the intestine to mix with the food as it comes from the stomach.

The Pancreas and What it Secretes. — The pancreas is a long, thin gland situated just below the stomach. It secretes the *pancreatic fluid*, which is necessary to digest the food.

Waste. — As the blood absorbs the food, it leaves in the intestine any food that is not digested properly, and all waste matter.

The Large Intestine. — The waste matter and any substances that are not digested pass from the

small into the large intestine. The large intestine is a tube similar to the small intestine, only it is larger around and not so long. It is about five feet in length, and through it the waste matter passes out of the body. The small and the large intestine together are called the *bowels.*

The Process of Digestion. — Let us review the whole process of digestion. The piece of bread bitten from the slice is chewed and partly dissolved by being mixed with saliva. The food is then swallowed and passes over the windpipe through the œsophagus into the stomach. There, by the digestive juices, it is changed into a soft pulpy mass. After an hour or two the small end of the stomach opens and allows a bit of the food to pass through into the small intestine. In the intestine the food is mixed with bile from the liver and is changed into a white liquid by the pancreatic fluid. The blood then takes the useful part of the food and carries it through the body to the organs that need it. The waste matter moves on into the large intestine and then out of the body.

Our bodies are carrying on this wonderful work

of digestion every day, but we do not realize it unless we are ill. As long as we are well we shall have little occasion to think whether our food is digesting or not. Tongue, teeth, saliva, stomach, and intestine will do their work if they are treated with proper care.

QUESTIONS

1. By what is food carried around the body?
2. What is digestion?
3. What have you in your mouth to grind food?
4. With what is the tongue covered?
5. What is saliva? How does it help to digest food?
6. How does food get from the mouth to the stomach?
7. What is the shape of the stomach? Where is the stomach?
8. What does the stomach secrete? What does this do to the food?
9. What is the small intestine?
10. What happens to the food in the small intestine?
11. How does the food get into the blood?
12. Where is it carried then?
13. What is the largest organ in the body? What does it secrete?
14. By what is pancreatic fluid secreted?
15. What part of the food does the blood take up?
16. What becomes of the waste matter?
17. Tell in your own words the process of digestion.

CHAPTER X

GOOD DIGESTION AND HOW TO KEEP IT

THE following table will give us some idea of the foods that are easy to digest, those that are less easy, and those that are hard to digest: —

TABLE OF DIGESTIBILITY

FOODS VERY EASY TO DIGEST	FOODS LESS EASY TO DIGEST	FOODS HARD TO DIGEST
Rice	Hard-boiled eggs	All fried foods
Tapioca	Boiled potatoes	Beans and peas
Milk	Boiled mutton	Boiled cabbage
Bread (cold)	Roasted mutton	Roasted pork
Soft-boiled eggs	Roasted beef	Roasted duck
Baked potatoes	Broiled pork	Boiled salmon
Codfish		Cheese
Boiled trout		
Raw oysters		
Broiled steak		
Boiled beef		
Boiled chicken		
Roasted turkey		
Roasted goose		

People who live an active life out of doors seldom have any trouble with their digestive powers. People who constantly have trouble with their stomachs, because their stomachs are weak or because they have not taken care of them properly, are called *dyspeptics.* Dyspepsia is often caused by eating *too much food,* by eating *the wrong kind of food,* or by eating *too fast.*

As you have already learned, even foods that are really *hard* to digest, like beans and peas, contain a great deal of nourishment and are good for us if eaten properly. The above table will help you to understand what foods you must eat carefully — that is, the foods which you must eat in small quantities at a time and must chew thoroughly.

QUESTIONS

1. Must we eat only foods that are *easy* to digest? Give the reason for your answer.
2. What is dyspepsia? By what is it often caused?

WRITTEN LESSON

1. From the Table of Digestibility and from what you have already learned about different kinds of foods, write a list of what would be a good dinner for a boy or a girl. You may have a soup, one kind of meat, two vegetables, and a simple dessert.

CHAPTER XI

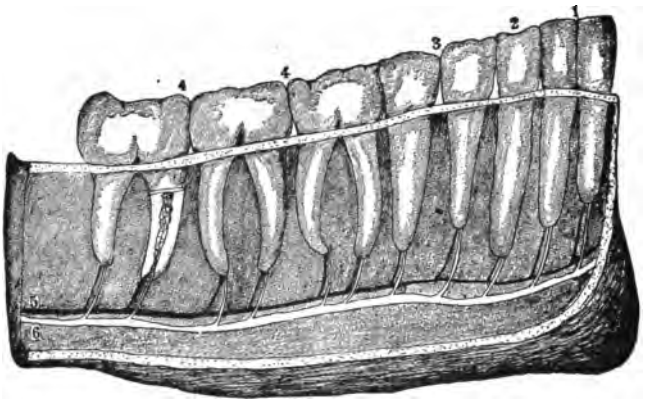
THE TEETH — THEIR FORMATION AND CARE

The Formation of the Teeth. — A tooth is a piece of bone covered on the outside with *enamel.* This enamel is a substance which is harder than any other part of the body. It is somewhat like the glazed porcelain on the outside of crockery. If very hot water is poured into a crockery dish, the glazing is liable to crack. If we take anything very hot into the mouth, or bite any very hard object, we are liable to crack the enamel of our teeth.

Inside the enamel there is the bone of the tooth, and inside the bone there are very small openings through which tiny blood vessels and nerves enter the teeth. The inside of a tooth is much softer than the enamel which covers it. After the enamel is cracked or decayed, the softer inside part decays very quickly.

If you should bruise a finger so that the nail should come off, another nail would grow; but it is not so with the teeth. We have just two sets

and no more in all our lives. The first teeth begin to form at the age of six to eight months. They



A SIDE VIEW OF THE LOWER JAW WITH THE OUTER WALLS OF BONE REMOVED, SHOWING THE TEETH IN PROPER PLACE

1, the two incisors; 2, the canine; 3, the two bicuspids; 4, the three lower molars (the last molar is sometimes called the wisdom tooth); 5, a blood vessel; 6, a nerve

keep on coming, one after another, for nearly two years, until there are twenty in all.

By the time the child is seven years old, the baby teeth begin to be shed, and in the place of each there comes a grown-up or permanent tooth, and other new ones grow up behind these. There are thirty-two permanent teeth. They keep coming until he is about twelve or thirteen years old. The last four, however, called *wisdom teeth*

do not usually come until a person is twenty years of age.

The front teeth are thin and sharp; they are fitted for biting food. The back teeth are larger and broader; they do the principal part of the chewing, or grinding of the food. The four front teeth of both the upper and the lower jaw are called *incisors*, or "scissors" teeth. The tooth next the incisors is a *canine*, or dog tooth. Then comes a *bi-cuspid*, or two-pointed tooth. The others are the *molar*, or grinding teeth. If you think of the word *miller* in connection with the word *molar* you will understand why the back teeth are so called. The miller does to the corn what the molar teeth do to our food — he grinds it.

The Care of the Teeth. — To keep our teeth in good condition, we must take proper care of them. If they are allowed to decay, we shall lose them and be compelled to go through life without teeth or to wear false ones. The teeth should be cleaned with a soft toothbrush every morning and particularly at night before bed-time. After each meal we should push from between

the teeth any bits of food that may have lodged there. We should use for this purpose nothing harder than a wooden or a quill toothpick. A piece of strong silk thread is even better than either one of these. Whenever we find the least bit of a decayed spot in a tooth, or if we have toothache, we should have a dentist examine our teeth at once.

Hard food is better for the teeth than soft food. A very important part of caring for the teeth is to use them for chewing proper food. The better we treat our teeth, the longer we shall keep them. With good care, teeth will usually last a lifetime.

QUESTIONS

1. What is a tooth?
2. With what is it covered?
3. How many sets of teeth do we have?
4. How long does the first set generally last?
5. How many permanent teeth are there?
6. What are *incisors?*
7. What tooth is next to the incisors?
8. What does *bi-cuspid* mean?
9. Why are the back teeth called *molars?*
10. If we do not use our teeth, and if we do not care for them well, what will happen to them?

CHAPTER XII

HOW THE FOOD IS CARRIED THROUGH THE BODY

We have learned how the solid food that we eat is made a liquid and then is taken from the intestine into the blood. How does the blood carry the digested food to the various parts of the body?

We know that a liquid cannot flow uphill. The blood might go down the legs into the feet because of its weight, but it would never run up to the brain of its own accord. The blood has to be pumped through the body just as water is pumped from the bottom of a well.

The Heart. — The heart is the pump of the human body, and is about the size of your closed fist. It is much like a strawberry in shape. The larger end of the heart is in the center of the chest. The small end points downward and a little toward the left.

If you place your hand upon the front of your chest, at about the level of the armpit and a little toward the left side, you can feel your heart beat. And if you listen, you will notice that it goes

like a clock, "Tick, tock — tick, tock," with a little pause after the "tock." With each "Tick, tock," the heart contracts much as we empty a lemon by squeezing. This contraction we call the *beat* of the heart. At the pause after each "Tick, tock," the heart rests for a little, less than half a second, and this is the only kind of a rest the heart ever gets. We rest our brains and bodies by sleep, but even while we are asleep the heart keeps on beating.

A Tobacco Heart. — Have you heard the expression a *tobacco heart?* The heart of a man who smokes much usually beats too fast, a condition which means that the heart is not healthy.

The boy who smokes cigarettes is very likely to develop a tobacco heart, or some other trouble. The boy who hopes to succeed in any business or any profession when he is a man, in these days of competition, must let cigarettes absolutely alone. In many prominent business houses and offices the first question asked of a boy who applies for a position is, "Do you smoke cigarettes?" If he does, he is not wanted. Business men know that the boy who uses cigarettes is, or soon will be, so

affected in mind and body that he cannot do good, strong work. No boy who wishes a sound heart in a sound body should learn to smoke.

The Pulse. — The throbbing movement of the blood in the blood vessels is called the *pulse.* You can feel it by placing the fingers of one hand upon the wrist of the other hand. You can also feel it directly in front of the ears or in the hollow at the side of the forehead (the temple). The heart of a grown person beats at the rate of about seventy-two times a minute. A child's heart beats considerably faster. We test the rate of the heart beat by feeling the pulse.

If you sit quietly for some time and count your pulse for exactly a minute, testing the time by a watch, you will find how many times your heart beats naturally in a minute. If you run about the room two or three times, and then count the pulse once more, you will find that the exercise has quickened the pulse; which means that your heart beats many more times in a minute.

The Blood. — You do not need to be told the color of the blood. It is the red in the blood that makes our cheeks and lips red.

Blood is made up largely of water, and, like water, the liquid part itself is colorless. You know that clear water has no color, and yet water in a mud puddle looks as if it were brown. This is because there are thousands of bits of brown soil in it, so near together that the water itself appears of a brown color. Blood looks red because it has in it millions of tiny, reddish particles. These are shaped like pennies, round and flat. They are called *red corpuscles.* The word *corpuscle* means "little body." The red corpuscles in the blood are so small that it would take more than three thousand of them placed side by side to make a row an inch long.

Besides these little red corpuscles there are other tiny particles floating in the liquid of the blood. These are known as *white corpuscles.*

The red corpuscles are the errand boys of the body. They pass around with the blood, carrying some of the air from the lungs to the other parts of the body. The white corpuscles are the street cleaners. They go about hunting for any poisonous germs that may cause trouble. The red corpuscles always stay in the blood vessels, not

moving of themselves, but going only where the blood carries them. The white corpuscles go wherever there is cleaning to be done, even if they must pass out of the blood vessels into the flesh itself, for they can move of themselves. If a splinter gets into your finger, so deep that you cannot pick it out, the white corpuscles will in time push it out for you. Your finger turns white, or "festers," about the splinter. That is, the white corpuscles from the blood gather around the splinter, and although they make the finger sore, they help to push the splinter out.

The liquid part of the blood has in it the food which was absorbed from the intestine. It carries this liquid food to all parts of the body.

Arteries and Veins. — The *blood vessels*, or the tubes which carry the blood, are of two kinds. Those that take the blood away from the heart are *arteries;* those that bring it back to the heart are *veins.* Both arteries and veins divide and redivide into thousands of little branches. These branches grow smaller and smaller away from the heart, until finally the very smallest arteries are so tiny that they are called *capillaries*,

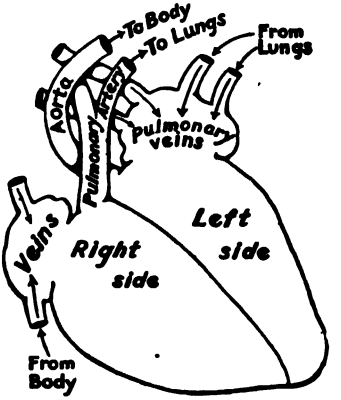
or hair blood-vessels. So small are they indeed that you cannot see them without a microscope. At your wrist are blue lines running from the hand up the arm. They are veins. Let your hand hang down a minute, and these lines show more plainly.

You have perhaps noticed that when you pump water from a well the liquid does not flow steadily, but comes from the spout in spurts, one spurt each time you pump. If the water is allowed to run from the spout into a long trough, after it is a few feet away from the spout it ceases to come in spurts and flows steadily along the trough. The blood also is pumped by the heart into the arteries by spurts. As it moves farther from the heart, the spurts are less pronounced. By the time the blood gets into the veins for the return journey to the heart, it flows as steadily as the water in the trough.

Circulation. — Let us go with a red corpuscle on its trip around the human body and see if it is not an interesting journey.

We will start at the heart. "Tick, tock," it goes, and our little blood corpuscle is pushed out of the right side of the heart into the lungs.

From the air in the lungs it picks up a gas known as *oxygen*. The oxygen, as we shall see, helps to make the blood pure. After taking its load of oxygen, the corpuscle goes back to the heart once more. This time it goes into the left side. Presently it comes out again from the left side, and starts on its journey over the body.



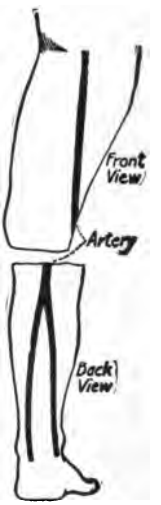
THE HEART

Together with millions of little particles like itself, it passes into the main artery of the body. The arteries, you remember, are the tubes that take the blood *away* from the heart. The main artery divides into several branches which carry blood to the head, the arms, the legs, and all the other parts of the body. Let us say that our corpuscle goes by way of the arm to the fingers. Leaving the main artery of the body and entering the large artery of the arm, it floats down the arm. This artery in the arm again divides into still smaller branches. We can feel the throbbing of the artery

at the wrist, as the blood containing the little red corpuscle passes into the hand.

Again and again the arteries divide and grow smaller, just as the large branches of a tree divide into smaller and still smaller branches, with tiny twigs as the smallest branches of all. Finally, in the finger tip itself the corpuscle ends its journey from the heart.

SHOWING THE MAIN ARTERY OF THE ARM



SHOWING THE MAIN ARTERY OF THE LEG

It now makes its way through a very tiny tube, or capillary, where the liquid part of the blood gives up some of the food that it obtained from the intestine before it entered the heart, and which it has been carrying through the heart and the lungs. The corpuscle also gives up the oxygen which it absorbed from the air while passing through the lungs, and the blood takes some of the waste substances from the tissues of the body.

When the blood came from the lungs, it was *pure.* Now that it has left the oxygen behind in the capillaries and has taken up some of the waste substances of the body, it is *impure.* It now enters a vein to begin its return journey.

From the small vein it goes on into a larger one, until finally it enters one of the large veins that take the blood back to the heart. Our corpuscle comes back into the left side of the heart again, and again starts on a similar journey.

One main artery carries the pure blood from the heart about the body. Two large main veins bring the impure blood back to the heart. The veins and arteries are connected by capillaries. The movement of the blood around the body in the blood vessels is called the *circulation of the blood.*

Have you noticed how red the face of a person becomes who takes large quantities of alcoholic drinks? This is because the alcohol causes the blood vessels of the skin to become larger than their natural size and they do not contract properly. The blood is thus allowed to pass through without being properly controlled by the natural expansion and contraction of the blood vessels.

QUESTIONS

1. Where is the heart? What is its size and shape?
2. How does the heart get the rest it needs?
3. What does the heart do by its beating?
4. What do you mean by the pulse?
5. How is blood like water?
6. What makes blood look red?
7. Of what use are the red corpuscles?
8. Of what use are the white corpuscles?
9. What are the blood vessels called that take the blood from the heart?
10. What are the blood vessels called that take the blood back to the heart?
11. What are the capillaries?
12. What do the red corpuscles get in the lungs?
13. When is blood pure? When is blood impure?
14. What do we mean by the circulation of the blood?
15. What effect has alcohol upon the blood vessels?

ACTION LESSON

Place your hand upon your chest and find where your heart is from the feeling of the heart-beats.

Feel the pulse at your left wrist; in front of your left ear.

Hold your hands above your head for a few seconds. How do they change color? Let them hang down. What difference do you see? Why is there any difference?

Shake your hands quickly. How do they change color? What is the reason?

Find a vein near enough to the skin so that it looks blue. Is it a straight line?

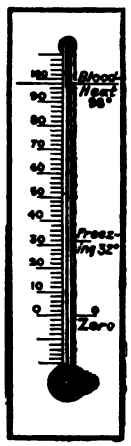
CHAPTER XIII

THE USE OF THE CIRCULATION

THE blood is constantly flowing through the capillaries, arteries, and veins. When the liver or the lungs or any other organ needs food or air, it takes this from the blood as it flows by. The blood will renew its food supply at the intestines after a meal, and its oxygen at the lungs. At the same time the blood is leaving food or air, it is taking up and carrying along with it any waste matter of which the organs must get rid.

The Temperature of the Human Body. — A fish, a turtle, or a frog is nearly always the same temperature as the water or the air in which it lives. In the summer the turtle, as it basks in the warm sun, feels warm to the touch, but in the winter it feels cold. In the winter the body of the turtle or fish is almost frozen in the icy water. The fish, turtle, and frog are "cold-blooded" animals. Human beings are "warm-blooded" animals. The temperature of a person in good health is always the same. By placing a

thermometer with a bulb under your tongue, you can tell how warm your body is. You will find it to be a little over 98° Fahrenheit, as warm as the hottest days of summer. Very likely at some time when you have been ill, the doctor has tested your temperature with a thermometer. Sometimes when people are ill, we say they have fever. We mean that their temperature is higher than it is in health. Sometimes the temperature is below normal, that is, lower than 98°. This, too, means that the person is not well.



THERMOMETER Showing blood heat

It is true that we feel warmer after playing tennis or raking hay on a hot July afternoon than we do after sliding down hill in January. It is, however, only the skin that feels warm or cold. We are just as warm inside our skin in the winter as in the summer. The blood vessels expand and contract. When the vessels in the skin expand, we feel warm because a larger amount of warm blood is passing through the skin where we feel the heat. When the ves-

sels contract, we feel cold because there is less of the warm blood passing through the skin, and the cool air cools the skin.

How the Blood is Warmed. — The blood in our bodies is always warm. It is warm because it flows through parts of the body that are burning the food we have eaten and thus producing heat.

The water in the boiler connected with the kitchen range is heated by burning coal in the stove, and may be carried in pipes to warm other parts of the house. So the blood is warmed by the burning, or *oxidizing*, we call it, of the food in our bodies. The warmed blood flows through the other parts that are producing little heat and warms them.

The blood in the interior of the body is warmer than at the surface. We do not notice its greater warmth so long as it is below the skin, but feel it only when the warmer blood is brought to the skin. For instance, we feel particularly warm after we have been running hard or taking much exercise, because the exercise brings more warm blood to the skin. We are really cooling off, however, since this warm blood is being cooled by the

air. If the body is likely to become too warm, it sends the warm blood to the skin to be cooled off.

If the blood circulates well, the body is warm all over. If the circulation is sluggish in the hands, feet, or ears, those parts grow cold. If your hands or feet are cold, the blood is not flowing through them fast enough.

The next time your fingers feel cold, instead of trying to warm them at a stove or over a register, rub them hard. You will find that they become warm quickly and stay warm for a long time. The rubbing starts the blood to circulating through them freely once more. Brisk walking or running is far better for warming the body than wrapping in heavy clothing or sitting over a hot stove or register.

QUESTIONS

1. Where does the blood get air to carry to the various parts of the body?
2. What is the main difference between the blood of a frog and that of a man?
3. Why do we feel warmer in summer than in winter?
4. When we feel warm, after playing hard, what is really happening to our blood?
5. What makes our fingers cold in winter when our bodies feel warm?

CHAPTER XIV

CUTS AND WOUNDS. — HOW TO TREAT THEM

Bleeding. — If there is a leak in a water pipe, the water flows out. If the leak is large, the water flows quickly. From a small opening it comes more slowly. If you cut your finger, you are almost certain to cut into a blood vessel, and then the finger bleeds. If it does not bleed, it means that you have so slight a scratch that hardly more than the skin has been pierced.

If an artery is cut, the blood flows out rapidly, in *spurts*. Do you remember why the blood in the arteries flows in spurts? We know when an artery has been severed from the way the blood flows out and from its bright red color.

If a vein is cut, the blood flows gently and evenly, never in spurts. The blood in the veins is darker red. Is this pure or impure blood?

A wound in an artery is much more dangerous than one in a vein, and it must be looked after at once. If the artery is large and the wound is not attended to, the person will bleed to death.

If we have a slight wound, such as a cut in the finger, the bleeding stops of itself after a short time. You may, perhaps, have noticed, when you have had a cut or a scratch, how the blood thickens in the opening itself, or outside of the cut on the finger. We call the thickened blood a *clot.* Blood clots after it flows out of the blood vessels. This clot closes up the wound so that the blood from within cannot flow through the opening.

How to stop Bleeding. — All we need to do for a small cut is to press the edges together and bind them in this position tightly with a *clean* cloth. This will keep the cut from bursting open again, and will allow it to heal. A *soiled* cloth should *never* be used to bandage a wound, even though the cut be only a slight one. Such a cloth is liable to hold harmful bacteria, which might cause inflammation in the wound. Every wound should be washed in clean, and preferably boiled, water, before it is bound up. The washing will take away any germs that might otherwise make trouble.

If the cut is deep, the bleeding may not stop

of itself. When a wound of any kind is followed by a *spurting* of bright red blood, an artery has been cut. The only way to stop the bleeding is to press the artery together *above the cut*, that is, between the cut and the heart.

Figure 1 shows how we may grasp an arm so as to stop bleeding anywhere below the elbow. The best way to stop the bleeding is to put a bandage tightly around the arm. To learn just how to arrange such a bandage, have a boy or girl bare the arm to the shoulder. We will suppose the arm to have been cut below the elbow. Wind tightly around the upper part of the arm a good-sized handkerchief. Tie it as shown in Figure 2.

FIG. 1. — SHOWING HOW TO COMPRESS THE ARM TO STOP BLEEDING

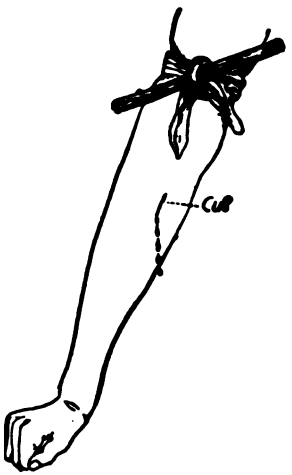


FIG. 2. — SHOWING THE METHOD OF APPLYING A LIGATURE

Now run a stick through the knot. Give the stick a turn or two, twisting the bandage and binding the arm tightly. With a wound in the leg, the plan for stopping the flow of blood is similar.

In case of a serious cut, the stick should be twisted until the bleeding stops. The life of the person may be saved by this means, and for this reason every boy or girl should understand just how to arrange the bandage.

A physician should be summoned at once. The bandage must be kept in position until the physician comes and the cut artery has been tied.

QUESTIONS

1. How do you know when a wound has opened a vein and when it has opened an artery?
2. What do we mean by a blood clot?
3. How should slight cuts be cared for?
4. How may the bleeding be stopped when an artery has been severed?
5. How long should the bandage be kept in place?

CHAPTER XV

HOW AND WHY WE BREATHE

Why we Breathe. — Ask some one to hold a watch, and count every breath you take for a minute. You could not get along for a single minute without breathing. Let us see why.

Place a lighted candle in a glass jar and put the cover on the jar. Notice how quickly the light goes out. The flame needs to take oxygen from the air, and when the oxygen is used up, it can no longer burn.

A fire will not burn in a stove unless it has air. If we want to make the fire burn well, we open the draft. The larger the draft, the faster the fire burns and the hotter the fire is. Besides a draft, the stove must have a chimney to carry off the smoke and gases made by the burning fire.

We can no more live without air than the fire can burn without it. To keep the food in our bodies burning or oxidizing, we must have air. The waste gases must also be carried off, as they are from the stove.

Respiration. — Giving the body its proper supply of air and carrying off the waste gases we call *respiration.* Every time we breathe in (which we call *inhaling*) we take air into our bodies. From the air the blood takes the oxygen it needs. Every time we breathe out (which we call *exhaling*), we send from the body waste gases and moisture.

Get some limewater from an apothecary and pour a little into a tumbler. Place one end of a glass tube in the mouth and the other end over the surface of the limewater. If you breathe in, so that air is drawn away from the tumbler, the limewater is unchanged. If you breathe out, so that breath passes into the tumbler, or better still, if you blow into the liquid through the tube, the limewater turns white. The gas which you send into the glass from your mouth turns the liquid white. Put your mouth a few inches from a cold mirror and breathe against the glass. The moisture which you breathe out gathers on the mirror in small drops.

The Chest. — When we breathe, we take air into our chests and then force it out again. The chest

is a box. The sides are called the *ribs*. The chest box is closed completely, except at the top, where the *windpipe* leads to the throat.

How we Breathe. — We can only partly control our breathing. We can hold the chest still for a minute, and we can take a long or a short breath. If we try to keep up such exercises long, however, we grow tired. As soon as we turn our attention to other things, the breathing takes care of itself.

We breathe by making the chest cavity larger, and thereby sucking the air into it. When we make the chest smaller again, the air is pushed out. With the aid of a rubber ball you can see just how the breathing is done. Place a hollow rubber ball with a hole in it under water and squeeze it. Notice how the air is squeezed out. Still holding it under water, let it expand. The ball fills with water. Every time it is squeezed, air or water rushes out. Every time it expands, air or water rushes in. In the same way, as the chest is made smaller or larger, the air rushes in or out. The chest, as you have learned, is a box; but it is a box with a curved top, curved sides, and a curved bottom. The sides and the

top are formed by bones. The bottom is a layer of soft muscle, called the *diaphragm* (dī'a-frăm). Below the diaphragm, on the right side, is the *liver*, and on the left side is the *stomach*.

When we breathe, we enlarge the chest in two ways. We lift up the bones forming the sides of the box, called the ribs. We also draw down the diaphragm. Place your hands on your sides, a little below the arms. Now take a long breath. You feel the ribs rise as you breathe in. Place your hand below the diaphragm. Take another long breath, and you will notice that the stomach seems to push out as you inhale. It is not air entering the stomach that makes it swell out, for air does not go to the stomach at all. The stomach swells out because the diaphragm is flattened downward and pushes against the stomach and bowels, and so pushes them outward a little. When the diaphragm is at rest, it curves upward until it is like a hemisphere in shape. When the lungs are full of air, the diaphragm is flat.

Nose Breathing and Mouth Breathing. — The nose was made to smell with and as a passage for the breath. The mouth was made as a pas-

sage for food. If your mouth is closed when the chest is enlarged, the air will enter the chest through the nose, as it should. If your mouth is open, the air will rush in that way because the passage is larger. When we breathe through the nose, we cannot help breathing slowly because the nostrils are too small to allow much air to pass at a time. By the time the air reaches the lungs it is warmed. When we breathe through the mouth, we draw a large amount of air down the windpipe so quickly that it is still cold when it reaches the chest.

If you cannot breathe easily through the nose, or if you breathe through the mouth when asleep, a physician should examine your throat. Never get into the habit of breathing through the mouth.

Have you noticed the little hairs on the inside of the nose? These are dust filters. As the air passes up into the nose, particles of dust are caught by the hairs and kept out of the throat and lungs. If the particles are large enough to cause a tickling, we blow them out. Sometimes they cause sufficient irritation to make us sneeze.

Chest Development. — Breathe out, or exhale, sending out all the air from your chest that you can. Find with a tape measure how many inches you are about the chest with the air breathed out. Fill the chest with air and measure again. How much larger is your chest when it is full of air?

Place your hands about your waist, pressing them as tightly as you can. Is the length of each breath shortened or lengthened by the pressure? When we expand our chests to take in air, the diaphragm presses down upon the stomach; so if the waist is compressed by a tight belt, the stomach and other organs are squeezed. After you have taken in a full breath, you should be able to slip two fingers between your belt and your body without the belt's feeling tight.

It is a good thing to have a large chest. It helps one to run fast and long, to have a good voice, and to be strong and vigorous generally. Boys may well be proud of chests that are full and expand several inches, for this means that they have strong muscles. The girl with a large, full chest carries herself well and is healthier. A person whose chest is small and hollow is apt to

stoop and may have weak lungs. *If you take a dozen long breaths several times a day, you can develop your chest.* The gymnastics given in many schools are a splendid aid to chest development.

QUESTIONS

1. Why does a candle placed in a closed jar soon stop burning?
2. What can we do to make the fire in a stove burn faster?
3. How do our bodies get air?
4. What is respiration?
5. What do we breathe in? What do we breathe out?
6. What does the gas that we breathe out do to limewater?
7. What do we breathe out besides the used gas?
8. What do we call breathing in? What do we call breathing out?
9. Where is the windpipe?
10. How do we breathe?
11. How is the chest formed?
12. What is the diaphragm?
13. Why should we breathe through the nose instead of the mouth?
14. What uses for the mouth can you think of? What uses for the nose can you think of?
15. What happens to our chests when we take in air?
16. What does your chest measure with the air breathed out?
17. What does it measure expanded?
18. What is the value of a large chest?
19. How may the chest be developed?

CHAPTER XVI

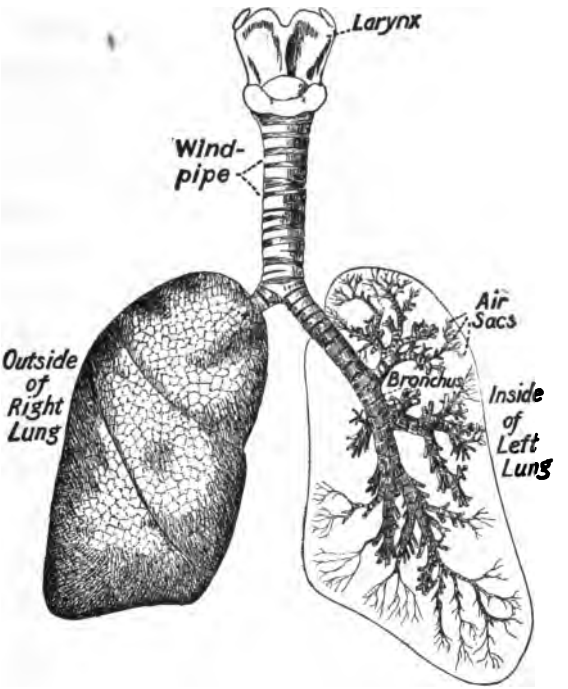
WHAT BREATHING DOES FOR THE BLOOD

The Air Passages. — As we draw in our breath we expand the chest. The air rushes through the nose into the throat and then into the windpipe. At the top of the windpipe, as you know, is the larynx, or "Adam's apple."

By placing thumb and finger upon the outside of the throat, just below the larynx, you can feel the windpipe, and the hard rings which keep it open, so that the air can enter it easily. At the top of the chest the windpipe divides into two branches, one going to each of the lungs. The air passes down the windpipe into the lungs.

The Lungs. — The *lungs*, two in number, are situated in the chest, one on the right side, the other on the left. If you wish to see what they look like, ask a butcher to show you a pair of ox's or sheep's lungs (or "lights" as they are called), You will find that they are pinkish gray in color, are slightly spotted with black, and look somewhat like a sponge.

The Breathing Tree. — To understand just how the air passes in and out of the lungs, let us pretend that the windpipe is the hollowed trunk of



THE BREATHING TREE

a tree, turned upside down in our body. The larynx will be at the root. The trunk, or the windpipe, runs from the throat down to the chest,

and there it divides into two large branches. One branch enters the right lung, the other enters the left lung. In the lungs each branch divides, like the branch of any tree, into smaller branches. These divide into others smaller, still. They divide and redivide again and again until they are only the tiniest of branches. They are so small that we could not even see them if we could look inside the lungs. Now comes the most wonderful part of the breathing tree. The trunk of the tree and also its branches are hollow instead of solid. At the end of every little twig or tube there are tiny air sacs, which, when full of air, are round and firm, like balloons. When the air goes out (the sacs are never quite empty), they partially collapse, like balloons half full of air.

Let us think how the air goes in and out of the breathing tree, whose hollow trunk is the windpipe and whose branches are in the lungs. Take a long breath and we will see what you do. As the chest rises slowly, growing larger and larger, the air is going in through the nose, down the windpipe, and through the two windpipe branches into the lungs. In this way air goes into every

tiny tube, and finally into the air sac at its end. When the chest has expanded as much as it can, the sacs and little tubes are full of air, much as if every leaf on a tree were a balloon filled with air blown into it through the twigs of the tree. As we squeeze the air out again, by letting the chest fall, the sacs partially collapse and the tubes sink together. The air we send out is impure air.

Besides the tubes and air sacs, all through the lungs are millions of tiny blood vessels. Through these tiny lung vessels all the blood in the body is pumped by the heart every few minutes. All of these little blood vessels pass into the very walls of the air sacs, and thus come very close to the air itself.

Why the Blood goes to the Lungs. — Why do you suppose the blood must make its way to the walls of the air sacs of the lungs? It does this to get air. While the blood is in the lungs, it becomes *purified*, as we say. When the blood goes to the lungs, it is impure blood; when it goes out from the lungs, it is pure blood. This is what happens: the air in the air sacs and the blood in the tiny vessels in the walls of the

sacs come very close together, so close that the waste gases in the blood go from the blood into the air and with the next breath are carried out of the body.

In the air sacs also, each red corpuscle seizes a bit of the good part of the air, the oxygen. As the blood flows out of the lungs again, these little corpuscles are hurried off, each carrying its load of useful oxygen. They carry the oxygen to the muscles, the brain, and other parts of the body, where the oxygen is needed. Thus the blood that has been through the lungs has been purified. It has given up its waste and has loaded itself with the good part of the air. In other words, the impure blood has been changed to pure blood.

QUESTIONS

1. When we draw in our breath, what happens to the chest?
2. Where are the lungs?
3. How does air get into the lungs?
4. What besides air goes to the air sacs?
5. What happens to the blood in the air sacs?
6. Where do the red corpuscles go when they leave the lungs?
7. Why should we breathe only pure air?

CHAPTER XVII

OUTDOOR EXERCISE AND VENTILATION

The Need of Outdoor Exercise.—Out-of-door air is the purest of air. For this reason, we should live in the open air as much as possible. Gypsies

AN OUT-OF-DOOR GYMNASIUM

are usually healthy and strong, although they are exposed to all sorts of weather. Soldiers in time of war seldom take cold, although they are often

obliged to sleep on wet ground. They keep well because they live out of doors. Such games as golf, tennis, football, and baseball are excellent for young people because they not only give exercise, but *out-of-door* exercise, which means that the player gets long breaths of good air.

Bicycling is fine exercise if the rider sits straight, rides slowly, and stops before he is too tired. Skating and rowing are also good exercises. Every boy and girl who lives near the ocean, a lake, river, or pond should learn to swim. Walking is a good exercise too, because it allows one to take fresh air into the lungs. But a simple walk is hardly sufficient exercise for children, who need something more vigorous. Children should run and jump as well as walk. If we wish the fire in a stove to burn faster, we open the draft and give it more air. Why do we breathe fast when we have been running?

LEARNING TO SWIM

The Need of Ventilation. — It is, however, impossible for us to stay in the open air all the time, especially if we live in a cold climate. Since we must live much of the time in the house, the next best thing is to bring in as much fresh air as possible. If several people in a room keep breathing the same air, and breathing out waste gases, in time much of the oxygen will be used, and the air will be full of impurities.

Air that has been breathed is unwholesome and may become poisonous. Some of its good parts have been taken out, and waste material from the blood has gone into it. If we keep on breathing air that has been breathed, we grow drowsy or have headache, and we are in just the condition to catch cold. Impure air usually has more or less dust in it, and it is apt to contain germs of disease.

Have you ever noticed a close, unpleasant smell in the schoolroom as you stepped in from out of doors or from another room? It was because the air was sufficiently impure to be unwholesome. When a number of people stay for some time in the same room, as in school or church, particular

care should be taken to keep the air pure. If there is no special way of ventilating a room, doors may be opened or one or two windows — and it is better to open the windows at the top.

An Open-air Gymnasium

Stoves help a little to ventilate a room by sucking in air at their drafts and sending it up the chimney; then more air must work in through doors and windows to make up for what passes out. An open grate is an excellent ventilator.

Every one ought to remember that fresh air is

necessary to good health. A house should be thoroughly aired every morning, even in winter, by throwing open the windows for a few minutes. We should be far more afraid of impure air than of drafts. To breathe in a room containing impure air is much more likely to give us a cold than to have a draft blow upon us. Fresh air is particularly needed when we are asleep. We should always have a window of our sleeping room open at night, even in the coldest weather. Out-of-door night air is not injurious. Breathing cold, pure air during the night will make us feel fresh and vigorous in the morning.

QUESTIONS

1. Each person in a room should have thirty cubic feet of air every minute. Get your teacher to tell you how many cubic feet of air your schoolroom holds at a time. Then find out for yourself in how many minutes the air would be impure, if no fresh air came into the schoolroom.
2. What is the best air?
3. Why should we take out-of-door exercise?
4. How may a schoolroom be ventilated?
5. How may a house be ventilated?
6. Why should we be particular to have the air fresh where we sleep?

CHAPTER XVIII

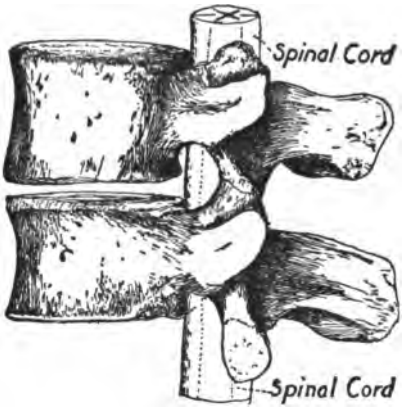
THE FRAMEWORK OF THE BODY

SUPPOSE there were nothing in our bodies but flesh, blood vessels, heart, stomach, and intestines. Suppose, in other words, we had no strong framework to hold us together. We should be somewhat like an earthworm or a jellyfish. The flesh is so soft that it must have a rigid frame to hold it up. This frame is called the *skeleton.*

The Bones of the Body. — The frame which holds our bodies in place is made of bones. The bones of the human body are similar in color and texture to those of an ox. A bone is so hard that it cannot be bent. It is so tough that it is not easily broken. Bones have in them material to make them hard and another kind of material to make them tough.

In the human body there are about two hundred bones of different sizes and shapes. Most of them are held together by *ligaments.* These are white, inelastic bands of small, straight fibers, somewhat like bundles of strong threads.

Running down the back is what is called the *backbone.* It is really a string of twenty-six small bones fastened together. If the backbone were one bone, it would be rigid and likely to break, but being made of so many small ones, it can bend a little in all directions without breaking. By moving your fingers along the backbone above the waist, you can feel the separate little bones. Inside the backbone is a very important part of the body, the *spinal cord.*



TWO OF THE TWENTY-SIX SMALL BONES THAT MAKE UP THE BACKBONE
Showing a piece of the spinal cord passing through them

The *skull* is a bony box at the upper end of the backbone. It protects the brain within, and it holds the eyes, ears, nose, and mouth.

The Ribs. — The *ribs* are twenty-four in number — twelve on each side of the *breastbone.* The breastbone, (see page 94), begins just below the neck in front. The upper ribs on each side

are fastened to the backbone (see cut) as well as to the breastbone. The two lowest on each side are called *floating ribs*, because they are not connected either with the breastbone or the other ribs. Point out on the diagram the breastbone; the floating ribs; the true ribs. Find the position of your ribs with your fingers. Find the location of the floating ribs. The ribs that arch around to meet the breastbone surround the cavity called the *chest*. Within the chest are the heart and lungs.

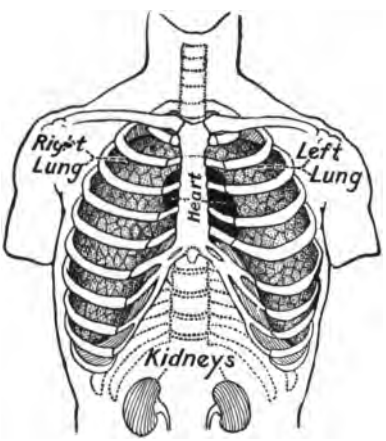
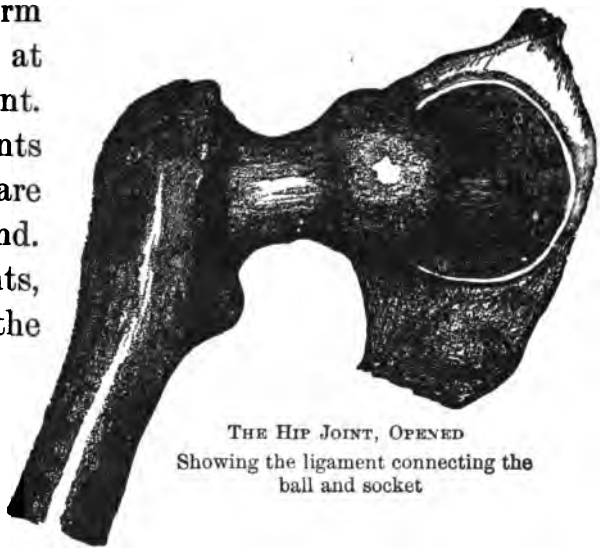


DIAGRAM SHOWING THE POSITION OF THE BREASTBONE AND RIBS; ALSO THE LUNGS, HEART, AND KIDNEYS

The Arm and Hand. — From the top of the chest and on the sides hang the arms. There are several parts to the arm. The upper arm has a single strong bone. The lower or forearm has two bones. The wrist consists of several small bones bound firmly together. The arm ends in the palm of the hand and the fingers. There is a separate

bone between each two finger joints. Has the thumb the same number of bones as each finger?

The Joints. — When two bones come together, they are united by what is called a *joint*. We can bend the arm, because the bones of the upper and lower arm come together at the elbow joint. Not all the joints in the body are of the same kind. Some of the joints, like those at the elbow, can be moved in but one direction. They bend like the hinge on a door or a box, and thus they are called *hinge joints*. Others allow the bones to be turned in any direction. They are *ball-and-socket joints*. The joints of the fingers, the wrist, the elbow, the toes, the ankle, and the knee, are hinge joints. The joints at the shoulder and hip are ball-and-socket joints.



THE HIP JOINT, OPENED
Showing the ligament connecting the ball and socket

Growth of the Bones. — Although bones are hard and tough, they are alive, and they grow. We can see the growth of a child from year to year. The bones of grown people do not grow, but, as you have already learned, they need repair.

A Graceful Body. — Every boy wishes to be strong and manly in appearance; every girl wishes to be graceful. We all admire a well-shaped body and would like to possess one. A well-built, graceful body depends as much upon the position and shape of the bones, as upon beauty of flesh and skin.

If we let our bones grow naturally, they will grow into the proper shape. We can help our bones to grow as they should by giving them the proper building food, and by never compressing the ribs or any part of the body by tight clothing or bands. If we wear tight belts or confine the bones in any way, they will be bent out of shape. For example, if we wear badly shaped or tight shoes, our toes will be misshapen.

We can keep the body straight if we get into the habit of standing, sitting, and sleeping with the body held straight. Stand with *head up*,

chin in, and *chest high*. A person who allows his head to droop forward and his neck to bend becomes round-shouldered. The lungs are compressed in the chest, and ill health may result.

Do not get round-shouldered by leaning over your desk when you study. We admire soldiers because they stand erect. You can be as straight as a soldier if you try.

QUESTIONS

1. What is the skeleton of the human body made of?
2. About how many bones are there in the human body?
3. How are the bones held together?
4. How many separate bones are there in the backbone?
5. Where is the spinal cord?
6. What is the skull? What does it hold?
7. How many ribs have we? To what are they attached?
8. What are the parts of the arm?
9. Name the hinge joints. The ball-and-socket joints.
10. What is meant by the *growth* of the bones in children? In older people?
11. Upon what does grace of body largely depend?
12. How can you help the bones of your body to grow naturally?
13. What is the danger from becoming round-shouldered?

CHAPTER XIX

DISLOCATIONS, SPRAINS, AND FRACTURES

SOMETIMES bones are pulled out of position at a joint. We call this a *dislocation.* Sometimes a joint is strained so that a few of the small bands, or ligaments, connecting the bones are torn. We call this a *sprain.* Occasionally a bone receives a blow or wrench sufficiently hard to break it. We call this a *fracture.*

Dislocation. — In the case of a dislocation, the bone wrenched out of place must be put back in its proper position before we can move it in the usual way. This should be done by a physician, unless some one happens to be present at the time of the accident, who understands *perfectly* how to put the bone back in its proper place.

Sprain. — When any one has the misfortune to sprain a joint, it is wise to have a physician examine the sprain. Strips of cloth kept wet with cold water or alcohol and wound tightly about the joint will relieve the pain until the doctor arrives. If no doctor is within call, the joint should be

bathed first with very hot water and then with cold. Pouring the water over the sprain is still better than bathing it. After the pain is relieved, bind up the joint tightly with bandages soaked in alcohol, witch-hazel, or any good liniment. For the first day or two after the accident the joint should be kept very quiet. After that it should be used a little every day to prevent stiffness.

Fracture. — In the case of a fracture, the bone will mend itself in time, if it is properly set. This, of course, should be done by a surgeon. To set a bone, the two parts are brought together, exactly as they were before they were broken. The arm or leg is then bound firmly to a piece of wood or put in a plaster cast to hold the bone in place until the parts have grown together again. This takes from six weeks to two months, or even more in the case of a severe break.

QUESTIONS

1. What is a dislocation?
2. What is a sprain?
3. What must be done to a bone that has been dislocated?
4. How should a sprain be treated?
5. What is a fracture?
6. How is it mended?

CHAPTER XX

HOW WE MOVE

TAKE a bean bag or a ball and throw it. If you had no bones, you could not have thrown the ball, but the bones alone could not have thrown it. Take the ball into your hand once more and put yourself into position for throwing it. Notice your right arm. Is it stiff and straight like the left one? Your left leg is straight and pushes against the floor. The right leg is slightly bent. The body is stiffened. You could not have taken this position if you had no bones; much less if you had no muscles.

PUTTING THE SHOT

The Formation of the Muscles. — The lean meat of an ox or a sheep is made up of some of the muscles of the animal. The lean meat or the flesh of our bodies forms the muscles. If you grasp your upper arm tightly, you can feel the bone. If you lay your hand lightly upon the arm, you feel only the muscle of the arm. There

are muscles in nearly all parts of the body. All counted, the muscles number about five hundred and form more than one half the body. They use up a large part of the building food we eat.

Muscles have the power of shortening and of being stretched out again. When they shorten or contract, they move the bones to which they are attached. When you clench your fist and bend your arm, the muscles of the upper arm contract. When you lift your leg to take a step, you contract the muscles of the leg and thus move the bones.

THE MUSCLES OF THE ARM, ENDING IN THE WHITE TENDONS AT THE WRIST

The Voluntary and Involuntary Muscles. — Some of the muscles we can move at will; they are called *voluntary* muscles. Some of them move without effort or control on our part; they are called *involuntary* muscles. There are also certain muscles that are partly voluntary and partly involuntary; that is, we can move them at will, but they can move without attention on

our part. We move our head, our arms, our legs, our fingers, and our toes as we like, using voluntary muscles. The muscles of the stomach push the food around inside without our being even conscious of the fact that they move. The muscles of the stomach are thus involuntary. We can close our eyes by shutting down the lids whenever we please, but we wink constantly without noticing the fact.

The Tendons. — The contraction of the muscles is what gives us motion. Muscles are usually larger in the middle than at the ends, and each is attached to two bones by cords called *tendons*. Grasp your left wrist, and then open and close the fingers of the left hand several times. You can feel the tendons at the wrist as the fingers move. The muscles that move the fingers are in the arm below the elbow. You can feel them by grasping the arm below the elbow and then opening and shutting the fingers. These muscles are connected with the fingers by the long tendons which you felt at the wrist.

The strongest tendon in the body is at the heel, the *Achilles' tendon*, or the *tendon of Achilles*.

If you are familiar with the old Greek stories, you will see why the tendon has this name. You remember that the promise was made to Achilles' mother that if her child was dipped in the river Styx, he could not be wounded in battle. So she picked up the baby *by the heel* and dipped him into the river. He was wet all over except on the heel. Years later the warrior was killed, shot through that very heel by a poisoned arrow.

SIDE VIEW OF THE BONES OF THE FOOT
T is the *tendon of Achilles*

QUESTIONS

1. What is the color of muscle?
2. Where are our muscles found? To what are they attached?
3. How many muscles are there in the human body?
4. How do the muscles move our bones?
5. What is the difference between voluntary and involuntary muscles?
6. What are tendons? What is the strongest tendon called?
7. Find in what parts of the body you are using muscles when you walk.
8. Find in what parts of the body you are using muscles when you write on the blackboard; when you hold a book to read; when you lift a chair; when you run; when you sing.

CHAPTER XXI

HOW TO STRENGTHEN THE MUSCLES

EVERY one wishes to be strong. Boys like to show the large, hard muscle of the upper arm. They like to show how fast they can run or how much they can lift. Girls, as a rule, do not care so much for this sort of strength, but they ought to, for strong muscles help a person to work well and to play well.

You have already learned that you can strengthen the muscles by eating good building foods. Some people think they can make their muscles stronger by taking what they call a *stimulant*, that is, some kind of an alcoholic drink. This is a mistake. Alcohol tends to weaken the muscles rather than to strengthen them. The boy who takes alcohol in any form will never be a fine athlete. Good athletes take only nourishing food and plenty of outdoor exercise.

Using the Muscles. — The more you use your muscles, the stronger they grow. You would find it difficult to lift anything heavier than your

own weight, yet the trained athlete at the circus holds half a dozen men at one time by poise and strength of muscle.

The more we use our muscles, the stronger they grow. If, on the other hand, we do not keep our muscles at work, they grow weaker. Little babies have muscles by which they can move their toes much as you can your fingers. After their feet have been confined in shoes for a few years, these muscles lose their strength, until they are of very little use. If you had used your toes as you have used your fingers, instead of shutting them up in shoes, you would be able to pick things up from the floor with your toes.

It is the same with all the muscles. Young children are so active that they keep nearly all their muscles in use, but when they get older they think that such things as running and jumping are undignified. The result is that their muscles lose much of their grace and quickness of movement.

If we wish to be strong, we must *use our muscles.* If we wish to be graceful, we must *use them all.* We should be careful not to use the same muscles all the time. After skating for a time, the muscles

of the legs become tired. Go into the house and practise on the piano for a while, and in a short time you have forgotten that your legs ached when you went in. Keep up the piano practice too

A Gymnasium equipped for many Kinds of Exercise

long and the shoulders get tired. Each kind of exercise should be taken in a moderate amount.

Exercise. — There are many ways of taking exercise, some of which are play and some work. The best kind of exercise is something that keeps

you moving very actively and that you enjoy doing. This will keep both your muscles and your mind busy. This is the reason why games are so useful for children, and why hard and exciting games, if not kept up too long, are better than easy and quiet ones. Outdoor exercise makes children stronger, more healthy, and brighter scholars. This is true of both girls and boys.

STRENGTHENING THE MUSCLES BY THE USE OF INDIAN CLUBS

QUESTIONS

1. Of what use are strong muscles?
2. Does alcohol weaken or strengthen the muscles?
3. What kind of food do the muscles need?
4. What besides the proper food helps the muscles to grow strong?
5. What happens if you use only one set of muscles all the time?
6. What is the best kind of exercise for boys and girls?

CHAPTER XXII

THE COVERING OF THE BODY

The Outer and Inner Skin. — The body is covered with *skin.* It consists of two parts, an *outer* and an *inner* skin. The outer skin is constantly wearing away, while new skin grows underneath. The outer skin peels off in little scales. We call the scales that peel from the top of the head, and thus are caught and held by the hair, *dandruff.* The outer skin is not sensitive, and there are no blood vessels in it. The skin about the base of the finger nails and toe nails is outer skin. If you stick a pin through this skin, it will cause no pain.

The inner skin is under the outer layer of skin and is much thicker. It is very sensitive. It is full of blood vessels and will bleed if it is cut.

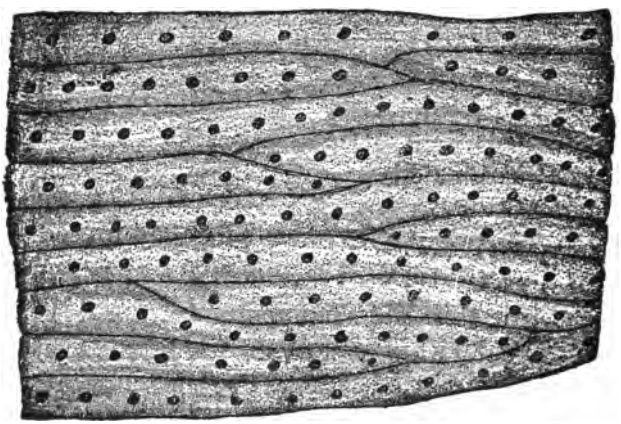
The skin is much thicker in some places than in others. In some places the skin is stretched tightly over the bones or flesh, as on the top of the head, the palm of the hand, and the knee. In others it is so loose that it can easily be

pinched up with the fingers, as on the back of the hand, the upper arm, the cheek, and the ankle.

Duties of the Skin. — The skin serves as a protection. The flesh and other parts beneath are very delicate and need to be kept from injury. The tough skin does this protecting work. Have you noticed that when you have played baseball for a few weeks you have hard places on the inside of your hand? If you have ever been barefoot for a few days at a time in the summer, you have found similar places on your feet. These hard spots (called *callosities*) are places where the skin has grown thick to protect the parts beneath from injury. Were it not for such hardening, the blows of the hard ball might injure the hands. The gravel would be apt to cut or wound the bare feet.

One of the most important functions of the skin is to keep out from the body the minute disease germs that are so often in the air. These might injure us if they should get into the body. Sometimes, when we have cut or bruised the skin, such germs do make their way in. The wound then becomes inflamed and very sore. To avoid

this danger so far as possible, all cuts and bruises, as you have already been told, should be washed with *clean* water and then bandaged with a *clean* cloth. This is especially important if the skin is



THE SURFACE OF THE SKIN
Highly magnified, showing the pores

not quite clean, for some of the most dangerous germs live in dirt.

The Pores of the Skin. — Hold your finger close to a piece of cold glass. Notice the drops of water that collect on the glass. Where do they come from? As you have already learned, a large amount of water is given out through the skin. Look closely at the skin of the fingers.

You will notice that there are on it many ridges. Along the top of each ridge there is a row of tiny holes, too small to be seen without a magnifying glass. They are called *pores*, and they lead into little tubes which come from *sweat glands*.

The Sweat Glands. — There are more than two million *sweat glands* in our skin. They are constantly taking water from the blood and pouring it out on the surface of the skin, where it generally dries and disappears. For this reason we fail to notice it. When we work or play hard, or the weather is warm, moisture comes through the skin so fast that it collects in drops. We then say that we are *perspiring*, but we are really perspiring all the time. If for any reason moisture fails to come through the skin, we become ill at once. When a person has fever, his skin is dry and hot; that is, he is not perspiring properly.

Some furnaces are so arranged that when they reach a certain degree of heat the draft shuts of itself. When the fire has cooled to a certain degree, the draft opens again. The skin serves a somewhat similar service for our bodies. The skin, in other words, acts as a heat regulator.

Although we perspire most when we are hot, the perspiring does not make us warm, but, on the contrary, actually cools us off.

If there were not some way of regulating the heat, our bodies would frequently become much too warm or too cold. When we work hard, we get warmer, because we are burning up more food. The warm blood then flows quickly to the skin to cool off. Have you noticed how red a person's skin becomes when he is working hard? This is because the warm blood is flowing through it to get cooled. On the other hand, if the room or the air is cold and the body is chilled, less blood goes to the skin. Thus it does not get cooled, and the heat is kept in the body. The process is somewhat like the regulating of the heat in a room by opening and shutting a window. If the body gets too hot, the hot blood goes to the skin, and the sweat pours out upon it, thus cooling us off, just as the window is opened when the room is overheated. If the body is cool, the blood goes slowly to the skin, and the sweating partly stops, just as the window is closed again when the room is cold. In this way the heat of the

body is almost the same in winter and in summer, no matter what the air outside may be.

The Hair an Aid to the Skin. — The *hair* helps the skin to protect our bodies. Hair grows on all parts of the body except the palms of the hands and the soles of the feet. Each hair has at its root a little *oil gland*, which secretes oil enough to keep the hair soft. It is, therefore, not necessary to use hair oil, although after washing the hair with soap a little vaseline rubbed into the roots is good.

The Nails. — The finger and toe nails are, like the hair, a peculiar growth of the outer skin. They are, in fact, parts of the skin, and protect the ends of the fingers and toes from injury. If a nail is injured, a new one grows in its place.

The Skin and the Kidneys. — The body gets rid of part of its impurities through the skin. In addition, there are two important organs whose work it is to clear the body of the impurities of which the skin cannot get rid. They are called the *kidneys*. They are a pair of bean-shaped bodies, though much larger than beans, each kidney being some four inches long and one

and a half inches wide. They are located one on each side of the backbone about three fourths of the way down. (See cut, p. 94.) They remove a large amount of waste water and other waste materials from the body. The kidneys and the skin aid each other in keeping the body free from impurities.

A KIDNEY

A, an artery, *V*, a vein; *D*, the duct that carries part of the waste material from the body

QUESTIONS

1. With what is the body covered?
2. What two kinds of skin have we?
3. What is dandruff?
4. How does the skin serve as a protection to the body?
5. What are callosities?
6. Where are the pores of the skin?
7. How does the skin help to regulate the heat of the body?
8. Of what use is hair to the body?
9. What keeps the hair soft?
10. What are the nails? What purpose do they serve?
11. What organs aid the skin in keeping the body free from impurities? Where are they located?

CHAPTER XXIII

HOW TO CARE FOR THE SKIN

SINCE the skin has so many duties to perform it should be well cared for. If we allow it to become injured, it grows inflamed and gives us pain. If we allow it to get sluggish, perhaps by wearing too much clothing, we not only suffer from cold but we "catch cold" easily, and may become ill. If we rub the skin too hard, when it is not toughened by use, it becomes blistered. If it is not kept clean, it will become rough and unsightly. How shall we take care of the skin?

Toughening the Skin. — When you study Latin you will probably read Cæsar's account of the wars in the part of Europe known in his day as Gaul. Cæsar tells us that the Germans who lived beside the river Rhine used to bathe in the river every morning. Even in the coldest days of winter they would break the ice and plunge into the icy water for their daily bath. They were able to do this because from childhood they had kept the skin of their bodies tough.

We ourselves should not consider it a very

great feat to wash our face and hands in ice-cold water. Boys and girls who are so *fortunate as to sleep in unheated rooms*, and have a window open at night, sometimes find ice in their water pitchers when they dress in the morning. With practice we could get the skin all over the body as tough as that on our face and hands.

The more we can toughen the skin, the less likely we are to take cold. Yet in our cold climate, living as we do in very warm rooms, it is not safe for us to try the old German way of toughening ourselves. These Germans lived out of doors in all weathers, day and night. As a result, they could endure the exposure that would cause the death of people who live as we do nowadays.

Bathing the Skin. — Baths help us to keep the skin healthy and active. An active skin is one through which the blood flows briskly, and in which the pores or sweat glands are free and vigorous. Baths both clean and stimulate the skin. If we do not bathe frequently, the body acquires an unpleasant odor. The dirt and the waste matter from the body that collect in the

skin need to be washed off, for the sake both of looks and of health. The bath is more important as a means of stimulating the skin than for mere cleanliness. A bath in *cold water*, or a cold sponge or shower bath, followed by vigorous rubbing, is specially useful for this purpose. This has the same effect on the skin that exercise has upon the muscles. It makes the skin active and strong. Before breakfast is a good time for a cold bath, but it may be taken at night.

A warm bath cleans the skin but does not stimulate it. Cold baths are strengthening; hot baths may be weakening. A person who takes a cold sponge bath every morning is not liable to catch cold. If you acquire this habit while you are a child, it will keep you from much illness after you grow up. If you find that it takes considerable courage to put the cold water upon your skin in winter, wet just a few inches at a time — say an arm or one shoulder — then rub the part until it is aglow. It is a good plan to first dry the body with a linen towel, and then rub it with a bath towel. When your body has been bathed and rubbed in this way, the blood will be hurrying

through your veins, the skin will be in a glow, and you will be in splendid condition to begin the day. Air baths are always useful in keeping the skin vigorous. To take air baths, one need simply remove the clothing so as to expose the skin to the air. The body should afterwards be rubbed quickly with a bath towel.

The Care of the Nails. — The finger nails should be kept short enough so that there is no danger of their breaking. They should not, however, be cut or filed down to the *quick*, that is, to the tender part under the nail. The nails should never be bitten, for this habit is vulgar and spoils the looks of the nails. The nails should be kept clean. If dirt is allowed to collect under them the beauty of the hands is spoiled. Clean, daintily cared-for finger nails add greatly to a boy's or girl's attractive appearance.

Clothing. The Best Kind to Wear. — We wear clothing both for comfort and for adornment. Clothes do not make us warm, but they keep the heat of our bodies from passing out into the air. Clothing should be dark colored and heavy in winter. It should be light in both color and

weight in summer. Light colors shed heat and dark colors hold it. Can you see why white is the best color for summer and the least desirable for winter?

It is wise always to wear a woolen garment next the skin in winter, because wool is warmer than cotton and protects us from the cold. Wool may be worn in summer, also, if worn loosely. It then absorbs the perspiration and protects us from a sudden change in temperature. The clothing worn next the body should be changed often. It should always be removed at night, so that it may become dry and be aired while we are asleep.

It is unwise to wear furs and heavy wraps around the neck, for it makes the skin tender and we are more liable to catch cold. Leggings will protect the legs, so that children can play in the snow without danger of catching cold. Rubbers or rubber boots should be worn in wet weather. We wear hats in summer to protect us from the heat, and we wear hats in winter to protect us from the cold.

The Color of the Skin. — Sick people almost always look pale, partly because they are shut

ALL READY FOR WINTER SPORT

up in the house. Boys and girls who play out of doors in all kinds of weather have rosy cheeks. When we are out in the warm sunshine we become tanned, that is, the sun turns the skin brown. In other words, light, heat, cold, exercise, and *lack* of exercise, affect the color of the skin.

QUESTIONS

1. Why is it necessary to take special care of the skin?
2. What is the value of toughening the skin?
3. Should you sleep in a room with the heat turned on or the window closed? Give the reasons for your answer.
4. Why is frequent bathing important?
5. What is the effect of a cold bath on the skin? A hot bath?
6. What kind of clothing should you wear in winter? in summer? Why?
7. Why do we wear shoes? Why do our shoes have stiff soles? Why are the upper parts of the shoes made of soft leather? Why do we wear gloves? Which keeps the fingers warmer, gloves or mittens? Can you think why?
8. Why do we put on extra clothing when we go out of doors? Why do we carry umbrellas when it rains? and also when the sun shines?
9. What gives the skin a healthy, rosy color?
10. How much of the day do you spend out of doors?

CHAPTER XXIV

INJURIES TO THE SKIN

From the Cold.—Once in a while, on a very cold morning, the finger or toe gets frost-bitten, without the person's realizing how chilled the part has become. If, some day when you reach school, somebody should tell you that your nose or ear is frozen, go out of doors at once. Have a boy or girl rub the frozen place with snow, if there is snow on the ground, or, at any rate, thaw out the place gradually. The blood will then begin to flow again slowly, and the frozen member will be restored to its normal condition. If a frozen place is thawed quickly beside the fire, it is liable to become inflamed afterwards and to give great trouble.

Chilblains, from which children so often suffer in cold weather, are caused by the continued heating and chilling of the toes and heels. The difficulty may be prevented by wearing warm stockings and loose, thick shoes. Children who suffer from chilblains should bathe the feet with cold water every morning and every night during

the winter. Cold water will relieve the itching and burning for the time.

From Fire. — If the skin comes into contact with fire, or anything that is hot, it is burned. The burned place becomes inflamed and painful, and sometimes a blister is formed. For a slight burn, applications of cold water will usually give relief. A tablespoonful of cooking soda dissolved in a teacupful of water may be used for wetting cloths to place on the burn. If the pain is severe, after the first burning sensation is relieved, cover the place with vaseline. Renew the vaseline until the skin is healed.

Wounds made with the toy pistols used so often on the Fourth of July are very dangerous. Many children have lost their lives from such wounds. If you wish to shoot off caps on the Fourth of July, or at any other time, use some other kind of instrument than a toy pistol.

Blisters. — It frequently happens when the skin is rubbed too hard by work or an ill-fitting shoe, that a blister forms — that is, the outer skin separates from the inner skin, and a little watery liquid collects between the two. The blister warns us

by its soreness that we must be more careful until the skin has healed. It is well to let the water out by running a needle into the blister at one side, not through the blister itself.

Corns. — If the shoes press too tightly upon the toes, the skin is apt to grow into a thick bunch, which may become painful. We call such a bunch a *corn.* The way to avoid having corns is to wear properly fitting shoes, — neither too loose nor too tight.

Warts. — Sometimes the skin grows into little bunches called *warts.* If we let them alone, they will go away of themselves after a while. They are never caused by handling toads. They cannot be driven away by marking notches in a stick, by rubbing them with raw beef, or by saying any rhymes or incantations.

QUESTIONS

1. How should a part of the body that has been frozen be treated?
2. How can chilblains be helped?
3. What can you do to relieve a burn?
4. What is a blister?
5. Why are tight shoes injurious to the feet?
6. What is a wart?

CHAPTER XXV

HOW THE BODY IS CONTROLLED

SUPPOSE you sit still for a minute. What have you been doing in this time? Your heart was beating and the blood was circulating through the body. Very likely your stomach was digesting food, and the blood was taking some of it as it passed through the intestines. You breathed twenty times or more, taking in fresh air and sending out poisonous gas. You winked every two or three seconds, and probably you moved your hands and feet once or twice, besides swallowing, and rolling your tongue. With all these complicated actions going on at once there was no mistake and no confusion. When you meant to move a hand you did not make a mistake and move the tongue, nor did the blood that was needed in the stomach go to any other part of the body.

There was something else that you were doing in the minute while you were sitting still. You were *thinking.* You may have been thinking of your lessons, or of what games you would play

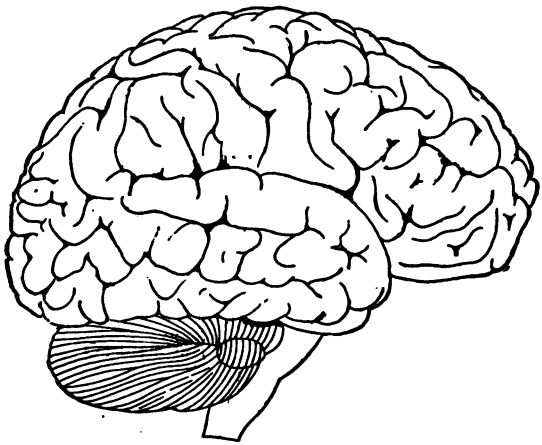
at recess, or of what you would have for dinner, or of all these things one after the other, and of several others besides. When we are awake, we are constantly thinking of something.

The Mind and the Brain.—The thinking part of us we call the *mind.* What starts the muscles contracting so as to move our legs when we wish to walk? What causes our hands to move so that we may pick up food and put it into our mouths when we are hungry? It is the mind, working through the brain, that does these things. It is the mind that makes all the actions of the body go on and keeps them moving in perfect harmony.

The *brain* is the part of the body that does the thinking. It is called the king of the body.

We think that we should like to run across the school yard at recess. Instantly King Brain orders our muscles to contract, and off we go. We think it is time to study. The brain makes our feet walk to the desk, our hands pick up the book and open it, and our minds to begin to learn the lesson.

The Formation and Power of the Brain. — The brain is shut up in the tight, bony box called the *skull*, and is formed of a rather soft substance. The outside surface is not smooth like a ball, but



THE BRAIN

is covered with small ridges and deep ditches, known as *convolutions*. The two sides of the brain are separated by a deep groove. The sides are called hemispheres. Can you guess why they have this name?

The human brain is the most wonderful thing on the earth. It is because our brains are more highly developed than those of other animals

that we can accomplish so much more than they. Man has brains so developed that he can think out and plan what is new. Thus we have clothing of woven cloth. We speed over the land in railroad trains and cross the ocean in steamboats.

The Activity of the Brain. — The brain, like the heart, is always at work. When we are asleep, however, it does not work nearly so hard as when we are awake. The duties of the brain are of three kinds. In the first place it receives reports from its messengers, which tell it what is going on outside of the brain box. After receiving the reports, it decides what should be done, and after deciding what is to be done the brain sends messages to all parts of the body, telling them what to do. The brain is all the time working in this way, although we scarcely notice it.

The brain and its helpers are like a telegraph system. The brain itself is the operator, which is constantly sending messages to this or that muscle, or to hundreds all at once. A telegram passes to its destination through wires strung on poles. A message from the brain passes to the muscles by means of tiny white cords, called *nerves*.

The brain is connected with every part of the body by these nerves. If you prick your finger, you feel pain. The pin touched a nerve. The nerve instantly sent a message to the brain, and the pain was the result. It is because of the messages going to the brain through the nerves that we feel heat, cold, and pain, and that we see, hear, taste, and smell.

QUESTIONS

1. Can you sit so still that your body will make no movement at all?
2. What is the thinking part of us called?
3. Where is the brain located?
4. What are convolutions?
5. Why can we do so many more things than other animals?
6. What are the three duties of the brain?
7. How does the brain send its messages to the various parts of the body?

CHAPTER XXVI

THE CARE OF THE BRAIN

Work. — We have learned that we must use our muscles if we wish them to grow strong. The brain, too, grows stronger by use. When you first went to school, you found it hard to remember how to spell the simplest words. Now you can read without thinking that it is difficult. When you first succeeded in adding a simple sum like 2 plus 3, you felt that you had performed quite a feat. It seems very easy compared with the examples you are working now. Children go to school in order that their minds may be trained to think. The better the brain is trained to do one thing at a time, the better it will serve us. The better servant we train our brain to be, the more useful men and women we shall become. Keep the brain busy.

Recreation. — "All work and no play makes Jack a dull boy," however. In order to keep his brain and nerves healthy, "Jack" must also have recreation, or play.

Games are the best form of recreation for chil-

dren. When we play active games, we use the muscles, and we receive such enjoyment that we rest our brains. Besides, we must learn to think quickly, if we are to win, and quick decisions mean a useful brain. It is by trying earnestly to win in the games we play that we enjoy them most. Reading is also an excellent recreation. It gives pleasure and at the same time is exercising the brain.

Sleep. — The brain never rests entirely, but it is relieved of much of its work when we sleep. The heart beats, and there is more or less movement of the muscles at all times, but we are not thinking, talking, moving about, or working when we are asleep. "Early to bed and early to rise, makes a man healthy, wealthy, and wise," so the old saying goes. We know that it makes him healthy, if he does not rise *too* early. How do you suppose that it might also make him wealthy and wise?

You should not try to study or work when you are sleepy. The lessons that you try to learn then you do not remember. It is better to leave them and go to bed. You can rise a little earlier than

usual and do the studying in the morning when you are fresh and can think quickly.

Sometimes, when we have eaten too hearty a meal at night, or when we are particularly tired, we do not sleep as well as usual. Instead of resting quietly, the brain is still somewhat active, and we dream. In the daytime when we think, our thoughts are sensible. We are thinking about things in which we are interested, as our lessons and our plays. When we dream, our brains are partly active and partly resting. The dreams are mixed-up thoughts, and consequently are often absurd. You can see how ridiculous it is to put any faith in what we dream. If a dream comes true, this is merely because it happens to. The dream was only a half-thought, coming from a brain that was trying to rest and could not do so completely.

Habits. — The brain continues to act in accordance with the training it has received. If we learn to do a thing in one way, the brain tends to keep on doing it in the same way. *Habits* are our servants. If we have servants, we want good ones. We ought to be careful to learn to do

things well while we are children, and then we shall have well-trained servants all our lives. We should get into the habit of sitting and standing straight. We should make it a habit to take regular exercise. We should always tell the truth. We should work hard when we work and play hard when we play. We should always be kind and speak pleasantly. If we form such good habits now, they will always stay with us, and will make our lives happier and better.

Going to bed at a regular time every night, having our meals at regular times every day, studying at regular hours, and performing cheerfully and without being told whatever duties about the house may fall to our share — all these are splendid habits.

Use of Narcotics. — There are certain drugs that put the brain to sleep. This is an unnatural sleep and very harmful. Such drugs are called *narcotics.* Opium and paregoric are narcotics.

Alcohol is a narcotic which is used even more commonly than opium. *Drinks that contain alcohol, such as beer, wine, ale, and whisky, dull the mind,* so that the person who gets the habit

of taking them cannot think clearly. Alcohol may weaken the muscles and deprive the brain of its control over them. The person thus loses control over himself more and more as he increases the use of alcohol. It may finally be the means of his death.

Sometimes children learn to drink beer because they think it will make them strong or because some older person urges them to take it. It does not make them strong, and by learning to use alcoholic drinks they are forming a habit that is likely to injure or even ruin their lives. It does not make a boy manly to take strong drink, nor does it make him a man more quickly. It really keeps him a boy longer, because it keeps his brain from developing. Thus alcoholic drinks are particularly harmful for children.

Use of Cigarettes. — Tobacco, also, has a bad effect on the brain. The boy who learns to smoke cigarettes loses his brightness and is almost sure to become a poor scholar. If you want to become a strong man, let cigarettes and all forms of tobacco alone. Cigarette smokers are usually neither bright scholars nor good athletes.

The keen, strong, healthy man is the man who succeeds in life. To be strong and capable you must have a clear brain. Train your mind by faithful study, strengthen it by work; keep it bright by sleep and recreation. Then, if you do not let it be injured by alcohol or tobacco, if you keep it healthy, you will have a capable brain, and this will help you to be also "wealthy and wise."

QUESTIONS

1. Why should we keep our brains busy?
2. What do we mean by recreation?
3. Why is it necessary for girls and boys to play as well as work?
4. How much sleep do children need?
5. What are dreams? Should you place any faith in them?
6. What is a habit?
7. Name ten good habits easily formed.
8. Have you formed them?
9. What is a narcotic?
10. Why should you let narcotics alone?
11. What happens to the brain of the boy who smokes cigarettes?
12. How can you train your mind? How can you strengthen it? How can you keep it bright and active?

CHAPTER XXVII

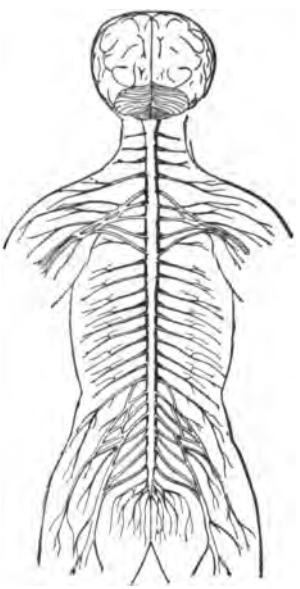
THE BRAIN'S MESSAGES

On a pleasant, sunny morning in spring, we enjoy walking through the meadows and fields. The air is warm, and perhaps there is a gentle breeze. The sky is a beautiful blue, and the trees and grass are moist with the dewdrops that glisten so brightly in the rays of the sun. The birds are singing their merriest songs. The air is sweet with the odor of the wild flowers growing beside the path. We perceive all these good things as we take our walk, and are glad.

How do we know that the air is warm? What tells us that the grass is green and the sky blue? We know that the birds are singing, but how? It is through the messages that the brain receives that we learn all we know of the outside world.

The Nerves. — You may wonder how the brain, shut up in its dark box, the skull, can know what is going on in the world. Messages are sent to the brain through little white threads, or *nerves*, extending from the brain all over the body. One large bundle of nerves runs down the back. It

is called the *spinal cord.* Hundreds of smaller nerves branch off from the cord and run into every part of the body. Some of the nerves go to the muscles, others to the skin. These nerves are nearly all connected with the brain and carry its messages to and from it. If some of the nerves are cut, the brain cannot send orders to that part of the body to make the muscles obey.



THE NERVOUS SYSTEM
Showing the brain and the spinal cord with its nerves

Kinds of Nerves. — The nerves that carry messages *to* the brain are different from those that carry messages *from* the brain. The latter carry commands to the different organs. Some of these are *motor*, or moving, nerves. When the brain wishes the fingers to be moved, it sends an order down the motor nerves and the muscles instantly obey. If a motor nerve should be cut, the muscle which it enters could not be moved.

The nerves that carry messages from the body to the brain are called *sensory* nerves.

If you pinch your finger, instantly a message passes along the sensory nerves to tell the brain about it. If the sensory nerves of the finger were cut, we might pinch as hard as we could without feeling any pain. The messages which the brain receives by way of the sensory nerves produce what we call sensations. There are five kinds of sensations, or *senses.* They are *touch, sight, hearing, taste,* and *smell.*

The Sense of Touch or Feeling. — Touch your skin in several places with the point of a pin. Can you find any spot that does not feel the point? Wherever you feel the pin, there must be a nerve to take the message to the brain. You can see how numerous the nerves of touch are. Some points of the skin are more sensitive to touch than others. You do not feel the touch until the message reaches the brain. It is not the finger that feels, but the brain.

The sense of touch tells us whether objects are hard or soft, smooth or rough, and whether they are pressing the skin forcibly or gently.

If an object presses the skin too hard for comfort, the message that goes to the brain causes pain. If anything is injuring our body, we are almost sure to have a feeling of pain. We are warned by the pain that something is wrong. Without the feeling of pain, children would often burn their fingers on the stove. Since the heat makes the child feel pain, he learns to keep his fingers away from the fire.

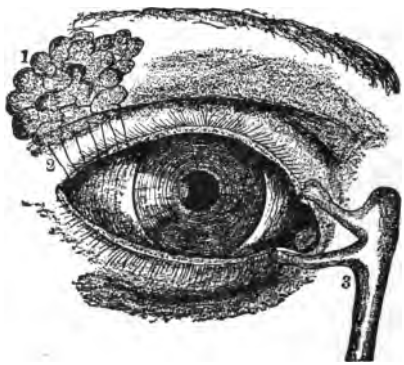
The Sense of Sight. — *The Eyes.* — Seeing makes it possible for the brain to know what is going on outside of the body, even at a long distance away.

The eye is a wonderful, but very delicate organ. The round part of the eye is the *eyeball;* the circle of color is the *iris,* and the black spot in the center of the iris is the *pupil.* This is really a hole inside the eye to let in the light. When we look toward a bright light, the pupil grows smaller. When we are in a place that is partly dark, the pupil grows larger to let in more light.

The eye is very carefully protected from injury by a little curtain of skin, called the *eyelid,* and by a fringe of curved hairs on the edges of the eyelids, called the *lashes.* Both the eyelids and

the lashes help to keep out any little particles or insects that might get into the eye and injure it.

The *tear gland* is just above the eyeball on the side away from the nose. It secretes tears slowly all the time, but usually the salty tears, after flowing over the eye to keep it moist and clean, run down into the nose. When we cry, or when anything gets into the eye, the tears are secreted faster than at other times, and thus they flow out and down the cheeks.



FRONT VIEW OF THE RIGHT EYE

1, the tear gland; 2, the ducts that carry the tears to the eyeball; 3, the duct that carries the tears to the nose

A special nerve, called the *optic nerve*, carries messages from the eye to the brain. Thus it is the brain that really sees what is outside the body.

The Sense of Hearing. — *The Ears.* — The sense of hearing tells us by the sound that comes to us what is going on outside of our bodies. Our *real* ears are inside of the head, where they are protected by the skull, but where we cannot see

them. What we call the ear is only a piece of skin and cartilage, or soft bone, that serves as a kind of trumpet to make sounds louder. The opening in the middle of the trumpet leads into a tube that passes to the real ear inside the head. A little inside of the opening, a thin skin is stretched tightly across this tube. It is called the *ear drum.* If the drum is injured, the person sometimes becomes deaf. The membrane is very delicate and for this reason it is unsafe to push any hard object into the ear. Very loud noises close to the ear are liable to injure the hearing. For this reason men who fire off cannon put cotton into the ears to deaden the sound.

It is by hearing that we understand what another person says to us. As some persons hear less clearly than others, we should learn to speak clearly and distinctly, so that we may be understood. A person who speaks distinctly is more readily understood than one who speaks in a loud tone of voice.

The Sense of Taste. — *The Tongue.* — The sense of taste is located in the mouth. We know by the taste whether what we take into the mouth

is pleasant or not. In this way, we can usually judge what should and what should not be eaten. Whatever tastes really bad is usually not fit to eat.

Children are sometimes fussy about their food, and because they do not *like* the taste of certain things particularly, they are unwilling to eat what is wholesome. Remember that the taste can be cultivated, that is, we can make ourselves really enjoy food that at first we dislike. Most people have to learn to like a few kinds of food, such as oysters, tomatoes, and olives. If you wish to be an agreeable guest at the home table or at the table of your friends, you will learn to eat whatever is set before you, refusing nothing that is healthful.

The Sense of Smell. — *The Nose.* — The sense of smell is located in the nose. We smell by sniffing air into the nose. We smell only gases. If a liquid or a solid body has an odor, it is because it gives off vapors or gases, and these pass into the nose. The sense of smell is of use in warning us of the presence of injurious gases in the air.

QUESTIONS

1. How do messages go to and from the brain?
2. What is the spinal cord?
3. Which way do the motor nerves carry messages?
4. Which way do the sensory nerves carry messages?
5. What are the five senses?
6. When do we feel pain? Why do we feel pain?
7. What are the parts of the eye? Are eyes all the same color?
8. What happens to the pupil when we look toward the light? What closes over a part of the pupil?
9. How are the eyes kept clean?
10. Where are the ears?
11. What is the ear drum?
12. Of what use is the sense of hearing?
13. Where is the sense of taste located?
14. Why should we cultivate our taste?
15. What is meant by the sense of smell?

ACTION LESSON

1. Touch the finger tips, the back of the hand, the forehead, the elbow, to various objects to find where the skin is most sensitive to touch. Feel some object that is hard; something soft; something smooth; something rough.
2. Write a word on the blackboard. How far away can you read it?
3. Find how far from the ear you can hear a watch tick.
4. Name ten objects, the smell of which is pleasant.

CHAPTER XXVIII

THE CARE OF THE EYES

Something in the Eye. — We wash our faces and hands when they are soiled; we bathe our bodies. It is not so easy to cleanse our eyes; so, to a great extent, they must take care of themselves. If a cinder or a bit of dust flies into your eye, you feel a sharp pain, and very soon the tears are rolling down your face. They are washing away the cinder. Unless it is caught tightly in some corner, or under the lid, the pain will soon be over and the cinder gone. If the tears do not quickly wash it out, take hold of the upper lid and draw it gently over the lower lid; remain quiet for a few minutes, and the tears will probably wash it away. If the irritating substance is not removed by this means, a physician should be consulted.

Bathing the Eyes. — Never rub the eyes. If, when you first awake in the morning, you find it difficult to keep them open, wash the lids with cold water. If, for any reason, the eyes ache, instead of rubbing them close the lids, and hold the fingers lightly over the eyelids for a few minutes.

After bathing your eyes, or face, always use a fresh towel, or one that has been used only by yourself. There are serious diseases of the eye that may be carried on towels from one person to another.

Using the Eyes. — The eyes were made to use, and unless we abuse them, they will serve us well all our lives. We may use them until they begin to ache. Then they are tired and need rest. It is a good plan, when we are studying, to look away from the book every little while, fixing the eyes upon some object at a distance. The green of trees or grass is a restful color to the eyes. If you can look out of the window at a bit of green once in a while, your eyes will return to the fine print much refreshed.

We should never read by a flickering light nor in the twilight. We should not allow a bright light to shine on the book we are reading, or into the eyes. We should not read lying down or when reclining in a hammock. The head should be held erect for reading. Never look steadily at a bright light. It is especially harmful to look directly at the sun.

Near-sightedness. — Children who read a great deal have sometimes the misfortune to become near-sighted. This means that they cannot see clearly objects at a distance from their eyes. The trouble is usually caused *by holding the book too near the eyes or by leaning over a desk to study.* We should sit erect to study, holding the book fifteen inches away from the eyes. Can you clearly see the words in this book when the page is twenty inches from your eyes?

If your eyes pain you or you have headaches when you study, tell your teacher or your parents, so that they may find out whether there is anything the matter with them or not.

QUESTIONS

1. How are substances in the eye usually washed away?
2. What can you do to help to get a cinder, or other particle, out of the eye?
3. What should you do for your eyes instead of rubbing them?
4. How can you rest your eyes when they are tired from reading?
5. How should you sit when you are studying? How should you hold your book?
6. What may happen to your eyes if you forget to do this?

CHAPTER XXIX

THE VOICE AND HOW TO TAKE CARE OF IT

The Tone of the Voice.—A horse was drawing a load of gravel along a city street. The pavement was slippery, and at the bottom of a little

"COME, JACK"

hill, horse and wagon stopped. The driver scolded and shouted. The horse became frightened and began to plunge wildly from side to side. This made the driver still more angry, and his voice rose

higher and louder. A crowd gathered. The boys in the street hooted. The poor animal became more and more nervous, until it really seemed that he never would be able to draw the load up the hill. Suddenly a woman stepped out from the crowd. Asking the horse's name, she talked quietly to him for a minute. Then she took hold of the bridle and said, "Come, Jack." The horse gave one long, strong pull, and the loaded wagon started forward.

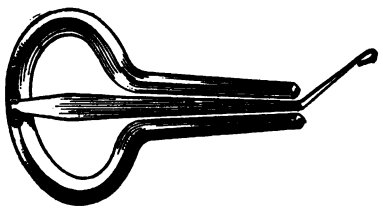
It was not the man's words that frightened the horse, or the woman's words that made him calm. It was the *tone of voice* that each used.

The Human Voice. — The human voice is a wonderful thing. A dog can bark, a cat can mew, a bird can sing; but each of these animals uses its voice in a single way. Human beings alone can make their voices form words and sentences. We can tell one another our very thoughts. We can sing and laugh and cry. We can ask people to do what we wish, and can tell our friends how much we love them. Yes, the human voice is indeed a wonderful thing.

How We Make Sounds. — In the front part of

the throat, where the windpipe begins, is a little box called the *larynx*. If you place your fingers upon the outside of the throat just below the jaw, you can feel a hard bunch move up and down as you swallow. This is the outside of the larynx, or voice-box.

The Vocal Cords. — Inside the larynx are two little flat bands, called *vocal cords*. These are stretched right across the middle of the voice-box, with just a little slit, or opening, between them. If you look at your open mouth in a mirror, you will see back of the lower jaw, at each side, a rounded mass of flesh. This is a *tonsil*. Just beyond the tonsils are the vocal cords, but you cannot see them. As we talk in low or high tones, these cords loosen or become more tightly stretched. The little opening between the cords widens or grows narrower.



A JEW'S-HARP

You have perhaps tried to play a Jew's-harp like the one you see in the picture. As the wire moved quickly in making the tones, you could feel

the vibrations, or quiverings, with your lips. If you have watched a person play a violin, you have noticed that the sounds were produced by drawing the bow across the strings of the instrument. The sounds are made by the vibration of the strings. The tighter the string is drawn, the faster it vibrates, and the higher the note becomes.

As we push air against our vocal cords, in breathing out, the cords vibrate, forming sounds. As we push the air out harder, the cords are drawn tighter, and the little opening between them grows narrower. When we sing, the cords vibrate faster for the high notes than for the low. They are constantly vibrating when we talk.

How the Voice is Shaped. — When the voice comes out through the mouth, it is shaped into different kinds of sounds by the teeth, the tongue, and the lips. You have found this out for yourself in learning how to form the vowel and consonant sounds. If the voice was not shaped into speech, as we call it, we should have a hard time understanding each other. All the sounds would then be alike, or differ only in tone or pitch.

Difference in Voices. — We know our friends by

their voices almost as well as we know them by their faces. If you should step into the sitting-room at night, when it is quite dark, and say, "Is any one here?" and some one should answer, "Yes, I am," wouldn't you know whether it was father's or mother's voice?

Each one of us, then, has a special voice all his own, as different from all other voices as his face is different from all other faces. But though we were given a particular voice, we can make that voice a still more pleasant and attractive one.

The Voice Expresses Feeling. — Have you ever thought how loving and sweet a mother's voice is when she is talking or singing to her baby? Have you ever noticed how unpleasant and unattractive a scolding voice is? Have you ever heard anybody whine? The tones of the voice express or show how we feel. If people are always scolding, the scolding voice becomes a part of their nature; if they are always discontented, a whine shows itself in the voice; but people who are happy, who are pleasant, have pleasing voices, and pleasing voices help us to win friends. Of course we do not always *feel* happy, but if we

think twice before we speak, we can keep out the whining or angry tone from our voices, and make them sound pleasant. It is just as easy to form the habit of speaking in a low, sweet tone as it is to use loud, harsh tones. Remember this:

A pleasant word is easy to say,
But a whining habit lasts many a day.

If we are loving and happy and good, we shall have pleasing voices. If we are fretful and cross and unkind, our voices will grow more unattractive every year we live. We may be sure the world will know what we are by the very tones we use when we speak.

The Care of the Voice. — You have learned that the brain and the heart and the other organs of the body must have rest, and that you should be careful not to overwork them. It is the same with the voice. The vocal cords are easily strained by screaming and by trying to sing at "the top of one's lungs."

We should not use the voice any more than we can help, when we are suffering from sore throat or when the voice is hoarse.

Sometimes people speak in an unpleasant manner that we call "talking through the nose." When a person talks this way, he isn't really talking through the nose at all, because the passages from the nose are stopped up from some cause, and the sound cannot come out through the nose. If this is caused by catarrh, it is better to let a doctor advise what remedy should be used.

If using nasal tones, or talking through the nose, is not caused by catarrh, but is just a bad habit, you should then make an effort to speak slowly and distinctly. Try to feel that you are pushing out the voice from the chest, instead of from the nose.

The voices of most children are sweet and pleasant to hear, and if they are taken care of properly they will be just as sweet when the children are grown up.

QUESTIONS

1. What calmed the frightened horse in the story?
2. How does the human voice differ from the voices animals?
3. What is the larynx? Where is it?

4. What are the vocal cords?

5. What happens to these cords when we make sounds?

6. What helps the vocal cords to shape sounds?

7. In what two particular ways can we tell one friend from another?

8. What does the tone of the voice express? What habit should we form in speaking?

9. How are the vocal cords often strained?

10. When should we be careful not to use the voice too much?

11. What do we mean when we say a person "talks through the nose?"

12. How can this be avoided?

CHAPTER XXX

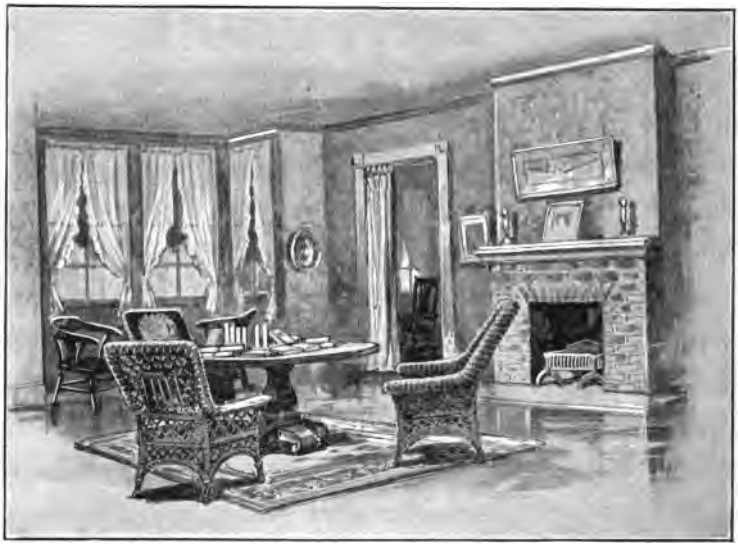
HYGIENE OF THE HOME

Cleanliness in Housekeeping.—"I'd like to have a house built so that I could turn on the hose inside of it and wash out every room," said a neat housekeeper once. That would surely mean a clean house and a healthful house, but not a very beautiful one. The only way to keep our houses free from dirt is to have them very carefully swept and dusted. There are not many little girls, and perhaps not any little boys, who like to help do the housework.

Did you ever stop to think that if *someone* didn't keep the house sweet and clean, we should probably be ill very often? That is because of tiny living things, called germs, that make trouble when they get into our bodies. Germs are apt to be found where dust and dirt gather. The dust scatters in the air. In this way we may breathe harmful germs into our lungs and poison our systems.

The dust and germs will not collect so easily if we have our rooms furnished like this one, with-

out too much furniture and with no heavy carpets and curtains. These catch and hold the dust, and it is never possible to get them perfectly clean.



A Healthful Living Room

Rugs can be taken up and carried out of the house to be beaten and swept, and then the floor beneath and around them can be cleaned and easily kept free from dust.

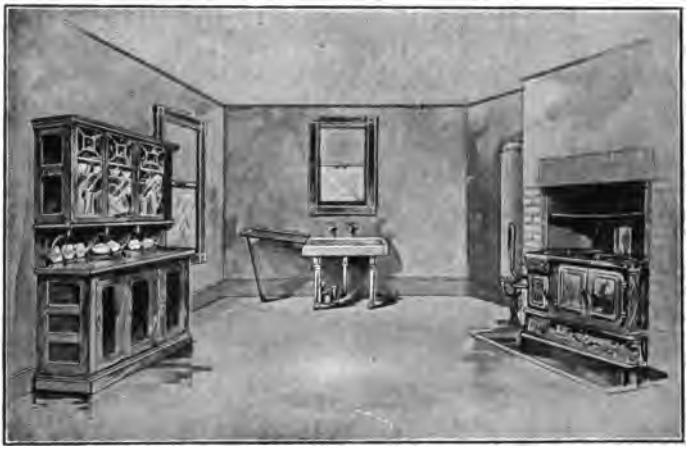
Dusting.—Whether you like to do it or not, some of you, no doubt, have to help mother with

the dusting. If you do, remember that it is better to use a *slightly damp* cloth (not a wet one) in dusting. Feather dusters only scatter the dust in the air. After a while the dust settles again just as thickly as before, and the germs settle with the dust. Particles of dust cling to a damp cloth and have no chance to go flying about. The dust cloth should be washed and dried after each dusting.

Sweeping.—"There's only one way that I know about to sweep a room," said an old lady, "and that's just to sweep it." But there are really many ways of sweeping a room. Did you ever hear of scattering wet tea-leaves over the carpet? The dirt clings to the wet leaves just as dust clings to a damp cloth. Wet pieces of newspaper, or handfuls of snow, may be used, too; or, if the room is to be just *lightly* swept, a damp cloth may be pinned over the broom. Always open the windows in a room when sweeping it, so that the dust may blow out and the fresh air blow in.

A sweeping-cap should be worn, or a cloth tied around the head to prevent the dust from getting into the hair.

Dish-washing.—You remember that contagious diseases may be caught by coming in contact with the person who is ill or by touching anything the patient may have touched. In a con-



A Sanitary Kitchen

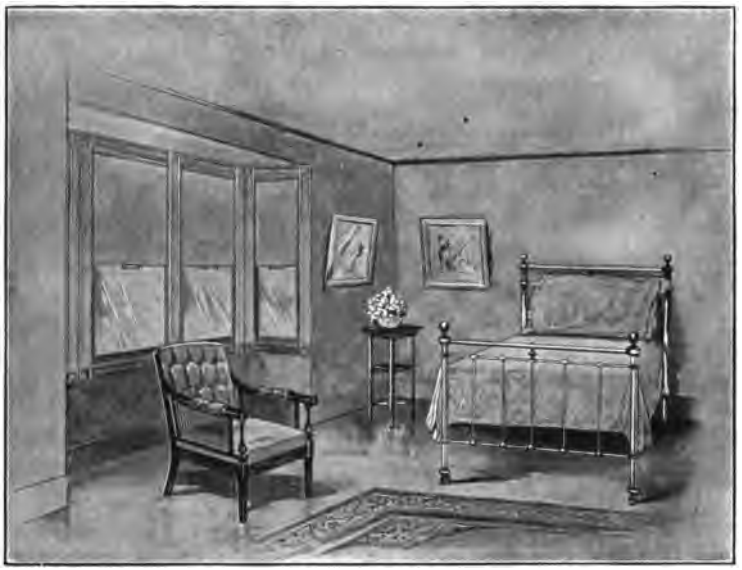
tagious illness, all the dishes used by the sick person ought to be washed *in boiling water.*

We should be careful, too, about every-day dish-washing. Everything should be washed in *clean* water and dried with *clean* towels. Soap and hot water destroy many germs.

Everything about a kitchen should be kept very clean. If our food is not pure and clean,

we cannot keep well. An orderly kitchen, like the one opposite, is very important to a healthful home.

Flies and Mosquitoes.—These little insects may



A Healthful Bedroom

carry disease germs. Mosquitoes carry the germs of malaria and yellow fever, and flies have been known to carry typhoid fever and some eye diseases. Care ought to be taken to keep them out of the house. They should not be allowed to

alight on our food or eating utensils. Food should be kept carefully covered.

Airing the Bedrooms. — When you first get up in the morning, always throw the bed covers over the foot of the bed, or else upon chairs, so that the covers and the mattress may be thoroughly aired every day. Before you leave the room, throw all the windows wide open, and let them stay open until after breakfast, at least.

Iron or brass bedsteads are the best to have, because the air can circulate about them, and they are easily kept clean.

The whole house should be aired at least once a day, even in cold weather. Any boy or girl old enough to go to school, is old enough to take the care of airing the house each morning.

Odors and Disinfectants.—Just because the air in a room may *smell* good does not prove that the air is *fresh and pure.* The air may be very "stale," as we call it, but it may smell sweet because there are flowers or some perfume, perhaps, in the room. One odor may *cover up* another odor, but it *cannot destroy it.*

Where there are bad odors, we may be sure the

place is not clean, and that there are probably germs there that need to be destroyed. There are substances that will destroy the germs and the bad odors, too. These are called *disinfectants.* Perhaps after some one at your home had been ill, the room was "disinfected." That means that some substance that would destroy disease germs was used in the room.

The bathroom and the sink in the kitchen should be often disinfected. Disinfectants are poisonous, and therefore only those members of the family who understand their proper use should handle them.

The Cellar and Yard.—Keeping the cellar and yard clean is more important than almost anything else in making the home a healthful one. Here is a chance for the boys to lend a helping hand. Old rubbish should be raked and burned up very often.

Never let rotten fruit or vegetables or garbage of any kind lie about the house, cellar, or yard.

What Home Means.—Home should be the happiest place in the world. A home is more than just a house.

To make a house a home, each person in it must be unselfish and thoughtful of the comfort of the others. If the house is to be a place where all can rest and be happy, it must be kept clean and in order.

You have heard the saying a good many times that "cleanliness is next to godliness." Do you begin to understand why? If we are not careful to keep our bodies clean and to live clean lives, we shall not be strong and well. If we are not well, we are generally cross and selfish and unkind. And "godliness" means happiness and unselfishness and kindness.

QUESTIONS

1. Why should we be likely to be ill if we did not live in clean houses?
2. What is the best way to dust a room? Why?
3. Tell two or three good ways to sweep a room. Why are they good ways?
4. How should the dishes be washed that have been used by a person ill with a contagious disease?
5. What does soap and water often do to germs?
6. Why should flies and mosquitoes be kept out of the house?
7. How should a bed be aired?
8. Can one odor *destroy* another odor?
9. What are substances that will destroy germs called?
10. Where should disinfectants be used in the house?
11. How can boys help in keeping the home healthful?

CHAPTER XXXI

HELP ONE ANOTHER HINTS

Knowing What to Do.—It is a splendid thing, when any one is hurt or ill, to be able to say, "I know what to do. Let me help you." In this chapter we are going to learn some simple things that even little children can do to help others, and also how they can help to take care of themselves. By knowing these things you may even be able to save some one else's life or your own, some day, so try not only to learn them now, but to remember them.

Stings or Bites.—1. *From Insects.* Once two little boys were out huckleberrying. They were having a fine time and their pails were nearly filled with the bright, shining berries. Suddenly one of the little boys gave a frightened scream, jumping up and down in pain. He had been stung on his face by a bee. "Oh, what shall I do?" he cried. The other little boy did not know of any way to help him. All he could say was, "Let's go home quick and find mother."

Would you have known what to do? The best thing to stop the pain would have been to put some cool mud on the spot. This always relieves the pain of the sting from any kind of insect.

Mosquito bites may be soothed by using a weak solution of ammonia water. Use one part of ammonia water to twenty parts of pure water.

2. *From Animals.* If any one is bitten by a dog or cat or any other animal, he should have

"LET'S GO HOME QUICK"

the place washed clean, and then see a doctor right away. The bites of animals are more dangerous than any other kind of wound.

3. *From Snakes.* If the bite is on the leg or

THE FIRST THING TO DO

arm, tie a handkerchief around *above* the bite and then put a stick inside the handkerchief and twist it tight to stop the blood. Then suck the wound. The poison will not hurt the mouth if spit out at once. If the place does not bleed, it should be squeezed or cut till it does. Send for the doctor at once, as some snake bites are very poisonous.

Poison.—If a person has swallowed anything that is poison, give him *immediately* a tablespoonful of mustard in a glass of warm water to make him vomit. The doctor should be sent for, of course, but while waiting for him to come, try in every way possible to make the patient vomit. If there is no mustard in the house, salt will sometimes do. If this is not enough, "gag" him by putting the handle of a spoon or the finger down his throat until he vomits.

Fire and Burns.—Everybody, boys and girls as well as big people, ought to know how to help a person whose clothing has caught on fire. One should catch up any piece of woolen clothing at hand, or a rug, and wrap it closely around the one whose clothing is burning. Then make the person lie down flat upon the floor or upon the ground and roll over and over. Without air, the fire cannot burn, and the rapid rolling, even if one cannot reach any woolen stuff, will usually put out the fire.

For ordinary burns, we were told what to do on page 123 of this book. Sunburn should be treated in the same way as ordinary burns.

Frostbites and Chilblains.—We have already learned, in the chapter on "Injuries to the Skin," what to do for these troubles.

Fainting.—If a person "feels faint," have him sit down and lean as far forward as possible, with the head between the knees. This will very often keep him from fainting.

If he actually faints, place him at once on his back, with the head as low as possible. That is the first thing to do. Then dash a small quantity

of cold water on the face. If there is any ammonia at hand, hold an open bottle near the patient's head, but not right under his nose. Unfasten the collar and the front of the waist, or shirt, so that he may breathe easily.

Nose Bleed.—Throw the head back and press a cloth wet with cold water to the nose. If the bleeding does not stop soon, put cold cloths or ice in a piece of oiled silk, if possible, against the back of the neck and raise the arms above the head, keeping the cold cloth to the nose. If this does not stop the bleeding, dissolve a little alum in water, wet a piece of absorbent cotton and press it hard against the nostrils, and draw the liquid up into the nose. Do not blow the nose for some time after the bleeding has stopped.

Bruises.—If the blow is on the head, and the child is stunned, bend the head slightly backward, and let him inhale smelling salts.

When the skin has been broken from any cause, the place should be washed with a solution of water and witch hazel, in the proportion of half a teaspoonful of the witch hazel to a pint of water.

If a child is bruised by falling, place a piece of cheese-cloth, folded several times and wet with cold water, on the bruise. If the skin is scratched, wash with the witch hazel solution. Then apply vaseline, and cover with a piece of cheese-cloth.

Headache.—Have the person lie down and put cloths wet in either hot or cold water on the forehead. Sometimes rubbing the forehead with the two hands, starting in the center, pressing gently but firmly, and rubbing down over the temples, will stop the pain.

Earache.—For earache, heat a little sweet oil (olive oil) in a teaspoon over the lamp, and being very careful that it is not hot enough to burn, pour it into the ear. Then put soft cotton in the ear.

Colds. — A well-known and very good way to treat a cold is to take a hot bath just before going to bed, and to have plenty of warm covers on the bed so as to make one perspire. One should be very careful after such a treatment not to get chilled.

Sore Throat. —If the throat is only slightly sore, it should be gargled with warm salt and water

every little while, and a wet cloth with a dry towel over it should be tied around the throat at night. In severe cases of sore throat, a physician should be sent for at once.

Something in the Ear.—If anything gets into the ear, bend the head down, on that side, and shake it If this will not do, pour some warm water or warm sweet oil in. If the object does not come out easily, let the doctor take it out.

Something in the Nose.—Close the other side of the nose and blow hard. If this does not bring the object out, tickle the nose to make the person sneeze. If it still does not come out, go to the doctor.

Something in the Throat.—If any one is choking from something he has swallowed, he should be slapped hard upon the back and made to cough. If it is a child that is choking, he should be held up by the feet, and shaken and slapped upon the back. This may seem cruel, but it is often the means of saving a child's life. A doctor should usually be sent for right away.

Cuts and Wounds.—For the treatment of these, see Chapter XIV.

Dislocations, Sprains, and Fractures.—These are treated in Chapter XIX.

We have now learned a great many simple things to do in case of accidents or illnesses that are happening every day. It is a good thing to remember these two rules: (1) If it is anything serious, send for a doctor at once, but (2) do everything you can think of to help the person until the doctor comes.

QUESTIONS

1. What is a good thing to relieve the pain from the sting of an insect?
2. What will relieve mosquito bites?
3. What should we do if bitten by a dog?
4. How should snake bites be treated?
5. Tell what you would do if you were with some one who had swallowed some poison.
6. If a person's clothing was on fire, what would you do?
7. If a person near you should faint, what is the first thing you ought to do for him? What should you do next?
8. How would you stop nose bleed?
9. What would you do for a bruise?
10. How may we help colds and sore throat?
11. What should we do to remove something from the ear? The nose? The throat?

CHAPTER XXXII

THE HOUSEHOLD MEDICINE CUPBOARD

How to Make One.—One Fourth of July, several children were having a grand time making tin cans shoot up into the air by putting firecrackers under them. Once they made an old silk hat go up as high as the house. That was great fun.

Suddenly one of the little girls began to cry. She had burned her finger quite badly, and ran into the house calling for her mother. But mother wasn't there, and the little girl couldn't find any vaseline or sweet oil, and she didn't know that soda or saleratus would relieve the pain. So she had to suffer great pain from the burn on her finger.

It is not enough, you see, just to know what to do in case of an accident. It is necessary to have remedies in the house and to know *where they are.* When you are in a hurry, you do not want to have to look on closet shelves, on mantels or through bureau drawers to find what you need.

Perhaps some of you live in a house where the

medicine cupboard is built into the bathroom. If not, medicine cupboards can be bought in furniture stores. Or why can't you boys make one? If nothing better is at hand, take an ordinary box and fit two little shelves into it. The shelves can be made from the cover of the box. Then get your mother or sister to make a little curtain to hang in front of the cupboard. This will keep the dust out. Many medicines, too, keep better away from the light.

THE MEDICINE CUPBOARD

What to Put in It.—In this cupboard should be put those medicines which your mother ordinarily uses when any one is sick. A bottle of witch hazel often comes in well in cases of bruises, sprains, etc. It is very convenient also to have a pair of scissors always at hand. Also put into the cupboard a spool of stout linen thread and a little box containing some pins and needles.

Absorbent cotton is another good thing to have. This is handy to use when it is necessary to wash the

blood from a cut. The cotton can be dipped into warm water or into an antiseptic, and after it has been used to wash the cut, should be thrown away.

All of you girls and boys have read stories about the Civil War, and know how the mothers and daughters of the soldiers used to make bandages for them. Of course bandages can be bought now all done up in little parcels ready for use. But it is easy to make them, and does not cost so much. Buy two or three yards of cheese-cloth and after it has been *boiled and dried*, cut it up into pieces a yard long and of different widths. Some of the bandages should be an inch wide, some two inches, some two and one-half inches. Fold or roll these lengths into bundles and put them into an ordinary preserving jar. Be sure to keep the cover on the jar, so that the bandages will be perfectly clean when you want to use them. Boiling the cheese-cloth *sterilizes* it, that is, frees the cloth from all impurities.

There should be also a yard or two of uncut cheese-cloth. This is handy in case of bruises or when the skin has been broken, as you have already learned.

You can think of a number of other things that ought to be kept in the medicine cupboard, if you remember the "Help One Another Hints" in the last chapter. There should be a piece of oiled silk, some powdered alum, some baking soda, a tube of white vaseline, some sweet oil. Mother will know of many other things to keep in it, and perhaps you can help her in printing labels to put on some of the bottles. Every little box and every bottle in the medicine cupboard should be plainly labeled, and nothing that is poisonous should ever be kept in the cabinet with the other medicines.

QUESTIONS

1. Why is it a good plan to have a medicine cupboard in the house?
2. Why should the cupboard have a curtain?
3. Of what use is absorbent cotton?
4. How can bandages be made?
5. Name as many things as you can remember that ought to be in the medicine cupboard in case of accident.
6. What do we mean by *sterilizing?*
7. Why should everything in the medicine cupboard be labeled?

CHAPTER XXXIII

SELF-GOVERNMENT

The Value of Good Habits.—One day, a young boy who had just finished grammar school, applied for the position of errand boy in a busy city office.

"Have you ever worked in an office before?" asked the business man.

"No, sir," answered the boy.

"Were you a bright boy in school, and quick at figures?" questioned the man.

"Not very, sir, but I tried hard."

"Humph," said the man, frowning. "I'm very much afraid you won't do for us. You haven't had any experience and you say you aren't quick at figures. What can you offer me?"

"Good habits," said the boy promptly.

The man's face brightened and he smiled pleasantly at the boy.

"Well spoken, young man," he said, laying his hand on the boy's shoulder. "I guess you'll do for us after all. Anyway we'll give you a chance."

Now that boy had good "working capital," as the saying is. Perhaps you have always thought

"'Good Habits,' said the Boy"

of capital as money, but there are other things that are good capital in the business world.

The boy who is pleasant and willing, and has

good habits, is pretty sure to succeed in whatever he tries to do.

The Value of Temperance.— We should be *temperate* in all we do. A temperate person is one who has learned to control himself, and tries to do not just those things that he likes to do, but the things that he knows to be right and best, for himself and for other people.

We are all *intemperate* in something, probably. Some of us eat too much, some of us play too much, some of us talk too much. And why do we? When we stop to think about it, we find that it is because we want to do these things more than anything else and we do not use our will power as we should.

It is always easier to do the thing we like to do, and to put off doing the disagreeable things. But, if we allow ourselves to grow up in this way, we shall make weak and selfish men and women. You have often heard people say, "He is a spoiled child." What do they mean? Simply that the child has been allowed to do everything he wished to do, whether it was good for him or not. So we spoil ourselves by not learning to say, "I will not."

We get into bad habits that will keep us from making strong, helpful citizens.

"Early to Bed."—When people ask us to do things that are pleasant and we want to do them, we do not often stop to think whether we shall be *intemperate* in doing them. It is easy to stay up later than we ought to, when we are having a good time. In the morning we are tired and sleepy and dull, and then we wish we had had the courage to leave the others and go to bed when we knew we ought to.

Controlling the Appetite.—Sometimes we eat food, not because we are hungry, but because we know it will taste good and we like it. When we are not hungry, it means that the stomach has all the food it can care for, and to eat more than we need always does us harm. Too much food gives the stomach and other organs of the body hard work to do, and soon they will get so that they cannot work well.

A little candy, especially at meal times, is not likely to do any one much harm, but if much of it is eaten between meals, it gives the organs that digest the food work to do when they should be

resting. Then, too, we can use only a certain amount of sugar, and if we eat too much of it, we cannot keep strong and well.

Playing Too Long.—It is all right to run, and shout and have lots of fun out of doors, but the boy or girl who is so fond of play that he is late to school, or does not get his lessons, or stays away from home after school so that he will not have to do the duties our little citizens ought to do, is intemperate. Unless he learns to control his liking for play so as to stop when he knows he ought to stop, he will find it hard as he grows older to be temperate in other things.

Besides, too much play often injures the body. If you have been running or playing ball for a long time and find that you are breathing very hard, stop for a while, until you can breathe quietly again.

Be careful never to lift things that are too heavy for you. And never do anything that you know is dangerous because some one "dares" you to do it. It is more manly to do that thing which you know to be best, even if your playmates do laugh at you.

Controlling the Temper.—Another way that we can be temperate is in the control of our feelings. What do we mean when we say that a person has a "bad temper"? We mean that when he gets angry, he does not try to control himself, and often says and does things that he is sorry for afterwards. This is a very bad form of intemperance.

You may have some reason to get angry sometimes, especially if any one does something dishonest or unfair; but when you are angry you are pretty sure not to see things exactly right, and if you will wait a little while you will be more likely to do and say just the right thing, and then you will be glad that you controlled your temper.

Danger from Cigarettes.—The boy who has good habits to offer in asking for a position has learned to avoid the temptation to use tobacco or alcoholic drinks. He knows that men will not think him manly or trustworthy unless he has learned this.

Little boys are very likely to think it is "manly" to smoke, because the big boys and the men do it. If they cannot have real cigarettes,

they sometimes use dry leaves or ferns instead of tobacco, and this usually does them no harm. But in the tobacco that is used in cigarettes, there is a poison that is particularly dangerous to boys, because the tissues of their bodies cannot resist it as well as if they were grown. This poison soon affects the lungs, and the heart, and the nerves, and then the mind, so that boys who have smoked for a long time stop growing and lose their strength; and sometimes they become insane.

"But I know plenty of successful business men who smoke," perhaps some boy says. And that is very true, but they are not successful *because* they smoke, and probably they did not begin to smoke when boys. They would be much better off if they did not smoke and did not drink.

There is something in this tobacco poison that makes people want more of it the more they smoke, and if we would be safe from this harm, we must try never to get the liking for it.

So if any one asks you to smoke or drink, be brave and sensible, boys, and say, "No, I cannot. I want to make a man of myself."

Governing Self.—A little city bootblack, only

twelve years old, was busy putting a fine polish on a customer's shoes.

"How much do you earn a week?" asked the man kindly.

"I Studied Lots of Things"

"Oh, about seven dollars," answered the boy proudly.

"Is that so?" exclaimed the man in surprise. "Ever go to school?"

"Yes, sir," the little fellow replied. "I studied lots of things—reading, and arithmetic and physiology. Did you ever hear of that study? That teaches you what alcohol and cigarettes do to you. I never smoke or drink, sir. Guess if I did, I wouldn't be making seven dollars a week. Do you think so, sir?"

"You're right, my boy," said the man. "I wouldn't ever touch the things, if I were you. Good luck to you," he added, dropping a shining half dollar into the boy's hand.

We all know by this time the terrible dangers of alcohol, and surely we will never be intemperate in that way. A boy is often asked to drink something just to be "sociable," but the brave boy always refuses, knowing that it is wrong. And since we know that temperance means self-control in everything that we do, can we not remember to practise it in our daily work and play?

Learning to govern ourselves is the hardest lesson we shall ever have put before us, and it is

a lesson that we must keep on learning every day of our lives. We can never expect to be successful men and women, men who know how to govern the country, or women who know how to govern their children and homes, unless we have first learned how to govern ourselves.

QUESTIONS

1. What is meant by being temperate in studying, talking, eating?
2. Why are we often intemperate when we know the risk we run in being so?
3. What two intemperate habits are the hardest for boys to break?
4. What great injury does smoking do to boys?
5. What is meant by self-government?

CHAPTER XXXIV

TWELVE EVERYDAY HEALTH RULES

1. Rise early and go to bed early.
2. Eat good, nourishing food.
3. Drink plenty of clean, fresh water.
4. Let tobacco and alcoholic drinks alone.
5. "Work while you work," and work cheerfully.
6. "Play while you play," and play heartily.
7. Take *plenty* of out-of-door exercise, especially in winter. Live out of doors as much as possible.
8. Keep the lungs active by taking long breaths.
9. Exercise the skin by cold baths and rubbing.
10. Do not wear tight clothing of any kind.
11. Be sure that the rooms you live and sleep in are well ventilated.
12. Train yourself to be the skillful engineer of your body engine. Be very ambitious to possess a strong, healthy, and graceful body.

GLOSSARY OF TERMS

Introductory Physiology and Hygiene

Alcoholic drinks, beer, ale, wine, rum, whisky, brandy, etc.

Appetite, the desire for food.

Artery, the blood vessel, or tube, that takes the blood *away* from the heart.

Backbone, the string of twenty-six small bones running down the back and containing the *spinal cord*.

Bacteria, little living plants often found in uncooked food.

Ball-and-socket joints, joints that allow the bones to move in *any* direction.

Bicuspids, eight two-pointed teeth, four in each jaw, between the canines and the molars.

Bile, the fluid secreted by the liver.

Blood-heat, the ordinary temperature of the human body, or a little over 98° Fahrenheit.

Brain, the principal organ of the nerve system, located in the skull.

Breastbone, the bone just below the front of the neck.

Canines, four dog teeth, two in each jaw, next to the incisors.

Capillaries, tiny blood vessels that connect arteries and veins.

Chest, the "box," or cavity, within the ribs, which holds the heart and lungs.

Chyle, the food after it has been digested in the small intestine.

Chyme, the food after it has been digested in the stomach.

Circulation, the movement of the blood in the blood vessels.

Contagious diseases, those that are easily transmitted from person to person; communicable diseases.

Corpuscles, the little red and white bodies in the blood.

Diaphragm, a layer of muscle, forming the bottom of the chest.
Digestion, the changing of the food we eat into liquid form, so that it may be carried to the various parts of the body.
Disinfectant, a substance which will destroy bacterial growths and purify the air.
Dislocation, the wrenching of a bone out of position at a joint.

Ear drum, the thin skin stretched across the tube of the ear.
Enamel, the outside covering of the teeth.
Exhaling, breathing *out*.

Fracture, a broken bone.

Gastric juice, a digestive liquid secreted by the stomach.
Germ, the tiny bacterial growth from which diseases originate.

Heart, the organ in the center of the chest, a little to the left, which controls the flow of the blood.
Hinge joints, joints that allow the bones to be moved in but *one* direction.
Hygiene, the study of the way to take care of the body.

Incisors, the four front teeth of both the upper and lower jaw.
Inhaling, breathing *in*.
Intestine: *small intestine*, the tube into which food passes from the stomach; *large intestine*, the tube into which food passes from the small intestine, and out of which waste matter passes from the body.
Iris, the circle of color around the pupil of the eye.

Joint, the place where two bones come together.

Kidneys, two bean-shaped bodies which remove some of the waste materials from the body.

Larynx, or "*Adam's apple*," the enlarged part of the windpipe.
Ligaments, the bands of white fibers joining the bones together.

Liver, a very large organ, or gland, on the right side of the body, a little above the stomach.

Lungs, two organs in the chest, where the blood becomes purified.

Molars, twelve grinding teeth, six in each jaw, back of the bicuspids.

Mouth, the cavity containing the teeth and tongue.

Muscles, masses of lean flesh attached to the bones, by which the bones are able to move.

Narcotics, drugs that put the brain to sleep, such as opium, paregoric, alcohol, and tobacco.

Nerves, the white threads that extend from the brain all over the body.

Œsophagus, the tube through which food passes to the stomach.

Oxidizing, the burning of food in our bodies.

Oxygen, one of the gases found in air.

Pancreas, a thin gland just below the stomach.

Pancreatic fluid, the fluid secreted by the pancreas, which turns chyme into chyle.

Physiology, the study of the body and its works.

Pores, openings in the skin through which sweat passes.

Pulse, the throbbing caused by the movement of the blood.

Pupil, the black spot in the center of the iris of the eye.

Respiration, giving the body its proper supply of air and carrying off the waste gases.

Ribs, the twenty-four bones forming the sides of the chest.

Saliva, the moisture in the mouth that comes from the *salivary glands*. It helps digest food.

Salivary glands, little pockets or glands in the mouth, which secrete a digestive fluid.

Senses, touch, sight, hearing, taste, and smell.
Skeleton, the bony framework of the body.
Skull, the bony box which holds the brain.
Spinal cord, the part of the nerve system within the backbone.
Sprain, the tearing or straining of ligaments at a joint.
Sterilize, to destroy bacterial or disease germs.
Stimulant, some kind of alcoholic drink overexciting a part or parts of the body.
Stomach, a kind of bag at the end of the œsophagus, which receives the food, and where digestion is continued.

Taste buds, little bunches on the tongue to tell us whether food is pleasant and good to eat.
Temperate, moderate, calm, not overdoing anything.
Tendon of Achilles, the tendon at the heel.
Tendons, cords attaching the muscles to the bones.
Thirst, the desire for water.
Tone, the sound of the voice.
Tuberculosis, a diseased condition caused by bacterial growths.

Vein, the blood vessel, or tube, that brings the blood *back* to the heart.
Vocal cords, the tough skin stretched across the voice-box which vibrates and forms sounds used in speaking and singing.
Windpipe, the tube through which air passes from the throat to the lungs.

INDEX

Introductory Physiology and Hygiene

THE PUBLIC HEALTH AND THE YOUNG CITIZEN

(Revised, February, 1914)

BY

WILLIAM A. SHEPHERD, M.D.

DIRECTOR OF MICROSCOPIC LABORATORIES IN THE MEDICAL COLLEGE OF VIRGINIA

PREFACE

COMMUNICABLE diseases and the methods employed in preventing them are to-day matters of popular interest. In recent years we have awakened to our possibilities in this direction and to a just appreciation of the results following an efficient application of the principles of public sanitation. Public interest is aroused, and there is a growing demand for educational work along this line.

The following chapters are intended to present simply and clearly the elementary principles involved. As most preventable diseases are of bacterial origin, the bacteria that cause them have received special attention.

Teachers who meet with any difficulties in connection with principles and facts given in the text, or who desire additional information, are cordially invited to communicate with the author or with the State Department of Health of Virginia, by whom any possible assistance will gladly be rendered. The bulletins of the department contain valuable and interesting material bearing upon the subject of public sanitation, and will be sent free to teachers and others making application for them.

The author wishes to thank the American Museum of Natural History for their courtesy in furnishing several illustrations.

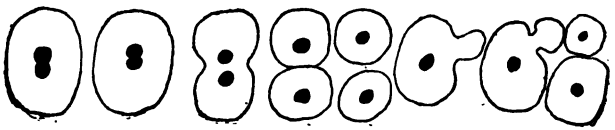
RICHMOND, VIRGINIA,
February, 1914.

THE PUBLIC HEALTH AND THE YOUNG CITIZEN

CHAPTER I

THE BODY'S TINY WORKERS — CELLS

Cells. — When you were reading about the blood on page 60, you learned that there are in the blood millions of tiny particles called corpuscles. These corpuscles are also spoken of as *cells*. There are other kinds of cells in the



CELLS REPRODUCE THEMSELVES

body besides those of the blood, and each kind has something special to do. All parts of the body are made up of cells, and your body grows because the cells grow and increase in number. These little cells are tiny, living things, and in many ways are like the body itself.

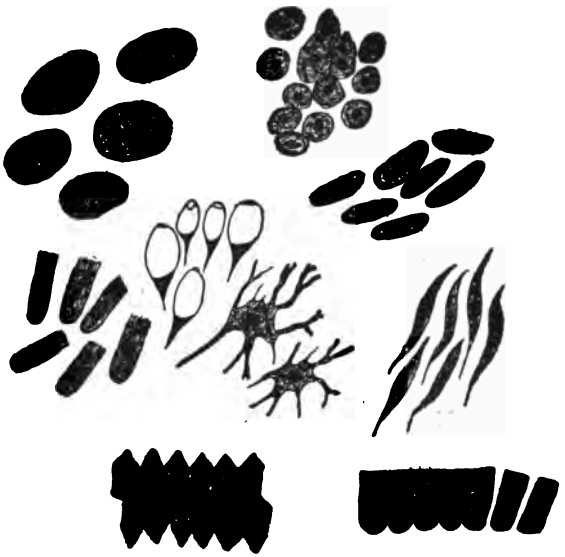
What Cells Do. — Cells grow and move and must be fed. They get their food from the food

we eat. They take it up and change it to suit themselves, and discard what they do not want or cannot use. They reproduce themselves and replace the cells that die. Many of them are busy removing from our bodies anything that would be hurtful to us. Some make substances that protect us from disease or help us to overcome disease. Others are busy making certain fluids that are necessary for our health. The saliva that moistens and helps us digest our food is a fluid that comes from the little cells that make it.

A great many cells placed together make up what we call an *organ* of the body. All the cells of the same kind in an organ are busy doing the same thing. The muscles in your arm are made up of cells, and these, working together, cause your arm to move. Your brain is composed of cells, and it is these cells that make it possible for you to think. One kind of cell in the wall of the stomach produces substances that help digest the food you eat. Other kinds cause the stomach to move and churn the food and pass it into the intestines. Every one of these little cells must

attend to its business or the organ cannot do its work, for you see it is really the cells that do the work.

Soldiers and the Army. — Have you ever seen a company of soldiers? An army is made up



SOME CELLS FROM THE HUMAN BODY

of a number of such companies. Every soldier must do his duty if the army is to be successful in fighting an enemy. The body is like an army. The different organs of the body are the

companies. As companies of the army are made up of soldiers, so organs of the body are made up of cells. If the companies in the army do not do their duty, the army cannot fight successfully. So if the different parts of the body do not do their duty properly, the body is weakened. All the different parts of the body are so dependent upon each other that, if one does not do its work well, the other parts cannot properly do theirs. When an organ fails to do its duty and so interferes with the work of the other organs, we say the body is diseased. Now, you have learned that all parts of the body are made up of cells, and when any part cannot do its work, it means that something has happened to the little cells that make up that part; that the army of little cells has been overcome by one of the enemies that cause disease.

QUESTIONS

1. What are cells?
2. What do cells do?
3. What is an organ of the body?
4. Upon what does the work of an organ depend?
5. How is the body like an army?
6. When is the body said to be diseased?

CHAPTER II

WHAT MAKES US SICK

WHEN we are sick there is always a cause for it. There are many things that can make us sick. Let us see what are the leading ones and try to arrange them in classes.

Injuries. — You can easily understand how a cut, or a blow, or a fall, could be the starting point of disease, or even cause death. A bad cut on your finger may make your finger very sore, and you cannot use it for some time, but this is not all. You may have heard of some one who had blood poisoning from a cut finger. Thus a cut may become the starting point for disease of the whole body, for the little cells are injured and may allow disease-producing enemies to enter the body.

Poisons. — *Mineral poisons* can cause disease. You probably know that arsenic will kill rats. It will also kill any other animal that eats enough of it. Poisons like arsenic are *mineral poisons.*

Animal Poison. — You know that there are

some snakes whose bites are poisonous. There are also some very small animals that you cannot see with your unaided eye which produce disease. These small animals enter the body and destroy the cells of the blood or attack the cells of the organs. Poisons that come from animals we call *animal poisons.*

Vegetable Poisons. — Do you know that there is a plant called poison oak that will poison your skin if you touch it? We call such a poison a *vegetable poison.* There are many of these plants that are poisonous, especially when taken into the body. Strychnine is a vegetable poison, and quite small quantities of it will cause death. Opium is a poison that comes from a certain kind of plant, and laudanum is a mixture of this poison with alcohol.

Bacteria. — The vegetable poisons you have been reading about come from plants that we can see with the unaided eye. There are, however, some little poisonous plants that we cannot see. We call these *bacteria.* These little plants called bacteria are the cause of many diseases, and we want to learn especially about them. Bacteria

enter the body in a number of ways and attack the cells. They may overcome the cells and destroy them or interfere with their work. When they succeed in doing this, we say the body is diseased. Remember that these bacteria are not the only cause of disease. You have learned that there are many other causes. But we are going to study bacteria and the diseases they produce because these diseases, as you will see, are *preventable*, that is, we can avoid having them.

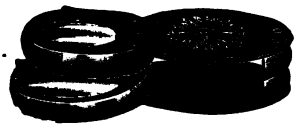
QUESTIONS

1. What may follow from a cut or similar injury?
2. Name a mineral poison.
3. Name an animal poison.
4. What is a vegetable poison?
5. Name four vegetable poisons.
6. What are the smallest vegetable poisons called?
7. Why are diseases due to bacteria said to be preventable?

CHAPTER III

THE QUEEREST LITTLE PLANTS IN THE WORLD—BACTERIA

Bacteria are Tiny Plants.—What is the smallest plant you ever saw? It may have been very tiny, but there are plants smaller still. These are bacteria. You have never seen, felt, nor tasted one of these little plants, so you would not know that there are such things in the world if somebody did not tell you or show you one. As we cannot see these bacteria with the naked eye, we have to use some means of making them appear larger.



A Magnifying Glass

The Magnifying Glass.—Many years ago a wise man found that a piece of glass of a certain shape would make things look larger when they were seen through it. So people began to use such a glass, and they called it a *magnifying glass.* Have you ever seen one? It is so called because it makes objects look larger.

The Microscope.—Another wise man found that

by putting several of these glasses together in a certain way things looked still larger, and he could see things that he could not see at all with his unaided eye. This was the beginning of what we call the *microscope.*

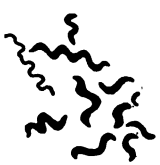
A Microscope

If you look at a hair through the microscope, you will see that it looks many times larger than it does to your unaided eye. Perhaps you will see the little scales on it, much like the scales on a fish. These scales are very, very small, but the tiny bodies that we call bacteria are much smaller, and it is only with a strong microscope that we can see them.

A Hair Magnified

Bacteria Differ in Shape and Size.— As we study them we see that they are of different shapes and sizes, and that some of them do things that others do not. For instance, we see that some bacteria swim around under the microscope very much like fish. Others which

may be of the same size and shape do not move at all. Some look like little balls or beads and these are called *cocci;* others are shaped like little rods and these are called *bacilli;* while still others are like corkscrews and have been named *spirilla* or spirals.



Cocci, Bacilli, Spirilla

Bacteria Differ from Other Plants. — Bacteria is a general name for all these plants, just as grain is a general name for wheat, oats, and barley. They differ in a number of ways from the kinds of plants that are familiar to you. For example, some parts of common plants are green at certain times of the year. Bacteria do not have this color at all. Then, too, all green plants must have air and sunshine, but many bacteria get along very well, and even thrive best, without either of these. The common plants get their food from the soil and the air, but many bacteria thrive only on food that comes directly from living or dead animals or plants.

Conditions of Growth. — Bacteria must have not only food, but, like all other living things, they

must have certain conditions for their welfare and growth. The bacteria that cause disease live and grow best when they are kept at the warmth of the body. They do not stand drying very well, and some of them are killed by this means. All of them will grow best if supplied with moisture. Damp cellars and damp houses are unhealthful chiefly because they furnish better conditions for the growth of these little plants.

Severe cold will kill some of them and will at least interfere with the growth of the most resistant ones. Remember, however, that cold will not kill all bacteria. As a striking example of this, we know that the bacteria of typhoid fever may remain alive for a long time even when frozen in a block of ice. Thus you can see how some persons have taken this disease by using ice from a pond that had typhoid bacteria in it.

QUESTIONS

1. What is a magnifying glass, and why is it so called?
2. What does a microscope do?
3. Are all bacteria alike?
4. What are cocci? Bacilli? Spirilla?
5. How do bacteria differ from common plants?
6. What conditions favor the welfare of bacteria?

CHAPTER IV

OUR SMALLEST FRIENDS AND ENEMIES

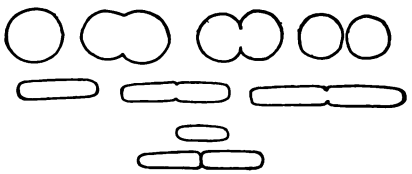
Bacteria are Everywhere. — Bacteria are found everywhere in the world and in vast numbers, but we must not think that all the kinds of bacteria are harmful to us. On the contrary, many of them are our very best friends and are necessary to us. If all kinds of bacteria were destroyed, all plants and animals would die.

GATHERING MISTLETOE

These useful bacteria exist abundantly in nature, and live upon dead plants and animals. If it were not for bacteria, dead plants and animals would not decompose, but would simply dry up. The bacteria decompose them so that they can

mix with the soil and become food for plants and, in time, for animals.

Now disease bacteria are like the mistletoe, which, as you know, grows upon a living tree, and feeds on the sap of the tree. So disease bacteria must feed on something that is living, if the bacteria themselves are to continue to live.



EACH PLANT DIVIDES AND PRODUCES TWO

Bacteria Increase Rapidly. — You know that all the seeds of wheat in the world come from other seeds of wheat that have been planted. So bacteria of any kind always come from other bacteria of the same kind; but unlike the wheat, bacteria do not come from seeds. Each little plant divides and so produces two. Since it does not take one tiny plant long to divide, you can see how this results in a very rapid increase of the bacteria.

COLONIES OF BACTERIA

How We May Grow Bacteria. — Bacteria can be caused to grow upon certain substances so that we can see the little colonies that they form. If we take some gelatine, which, as you know, becomes solid when it cools, and mix with this some soup made from the flesh of an animal, we shall have the kind of food that the bacteria will like. If we choose, we can let some bacteria from the air fall on this mixture, and after a while we shall see that the little colonies — as we call them — will appear. Thus we shall prove that there are bacteria in the air and that they will grow upon food prepared for them in a certain way. Every little colony contains its own kind of bacteria, and there are millions of them in each colony. In other words, each colony is a family all by itself, having a great many members all of the same name.

QUESTIONS

1. Are all bacteria harmful to us?
2. What do the useful bacteria do?
3. How are disease bacteria like the mistletoe?
4. How do bacteria differ from seeds?
5. How may bacteria be made to grow?
6. What is a colony of bacteria?

CHAPTER V

HOW TO FIGHT THESE ENEMIES

Bright Sunlight. — Bright sunlight is a powerful enemy of bacteria, and we have to thank the

A Sunny Playroom

sun for killing many of the harmful ones. Dark, damp places, where the direct rays of the sun never enter, make a good home for bacteria. In such places they will live for a long time. You can see how important it is that we should

live in rooms that have plenty of sunlight as well as of fresh air. For the same reason it is healthful to be out of doors as much as possible.

Heat. — Burning or boiling anything that has bacteria on it destroys the bacteria. If an article is of no value and we know that it has disease bacteria on it, it is best to burn it. If it is something that is valuable and can be boiled, this method should be employed. Boiling is a good way to kill bacteria on clothing that has been used by some one who is sick with a bacterial disease. Such things should be boiled at least an hour. Boiling water when poured over anything containing them will kill most of the disease bacteria.

Steam. — Sometimes steam is used for killing bacteria. In large cities there are big steam chests where clothing, mattresses, carpets, and such things are carried and disinfected. The steam passes all through these things and the heat destroys the bacteria.

The heat of an oven, or dry heat, will also kill bacteria. Of course there are many things that would be injured by such heating, and to them we

have to apply heat in some other way, or we have to use substances that are called *disinfectants.*

Disinfectants. — These substances called disinfectants destroy bacteria. Some of them have the power of destroying bad odors also, but it is not for this reason that disinfectants are so valuable. Bad odors are disagreeable, but they do not cause disease. The bacteria that so often go along with bad odors do cause disease. Disinfectants kill these bacteria and so prevent sickness. They must come in direct contact with the bacteria, and stay in contact with them for some time in order to kill them. It would not do any good to pour a disinfectant in the corners of a room, hoping by this means to kill the bacteria that were in the room. It would kill only those that happened to be in the corners and with which it came in contact.

All these substances that kill bacteria are poisonous. We should be very careful when handling them and be sure that they are properly marked and kept in the right place. Children should never handle them. Disinfectants should not be placed with medicines.

Some disinfectants are liquids. Others are solid substances and have to be dissolved in water before they can be used for killing bacteria. Still others are gases and can be introduced into a room where they will kill the bacteria in the air as well as those upon the objects in the room.

Lime. — A strong mixture of unslaked lime and water makes what is called whitewash. When this mixture is fresh it will kill bacteria pretty well. That is one reason why whitewashed walls are more healthful than papered ones. Whitewash does not keep its strength very long and must be made up fresh. It is not a powerful disinfectant and should be allowed to act on bacteria for a long time. However, it is cheap and easily prepared and is one of the most useful disinfectants. When used to destroy the bacteria in any matter that contains them, we should be sure to use plenty of it.

Carbolic Acid. — Carbolic acid is one of the best disinfectants. It is not usually employed in its full strength, but is diluted. To make a solution, about seven teaspoonfuls of carbolic

acid, as it comes from the drug store, are added to one pint of water. Like other disinfectants, carbolic acid is a violent poison and should be handled with care. The bottle should be labeled and kept where it will not be mistaken for something else.

Chloride of Lime. — Chloride of lime is sometimes called "bleaching powder." It comes in little tin cans which can be purchased at almost any grocery or drug store. When we add a fourth of a pound of chloride of lime to eight gallons of water, we have an excellent disinfectant. It is cheap, easily prepared, and will kill the bacteria of disease if allowed to act upon them an hour or more.

Corrosive Sublimate or Bichloride of Mercury. — This is one of the very best disinfectants, but it must not be forgotten that it is also a deadly poison. It is one of the mineral poisons and can be bought in little tablets. Eight tablets dissolved in one gallon of water will make a suitable solution for killing bacteria. The solution does not keep very well and should be made up fresh. It should be labeled "Poison," and

placed where it will not be mistaken for something else. Anything that we wish to disinfect should be covered by the solution and allowed to remain in it for some time. This is also a good disinfectant for wiping floors, walls, and articles of furniture that have bacteria on them. It must not be used on metal, for it will injure it.

Turpentine. — Turpentine is a good, cheap disinfectant, particularly useful in cuts to prevent the growth of those bacteria that cause a cut to become sore. A cut will heal up very quickly and not be sore at all if bacteria are kept out of it. That is why surgeons have everything so clean, and we mean by this that they have everything that comes near the wound free from bacteria, because it was found that bacteria prevent wounds from healing. The knowledge of this fact has made possible the wonderful things that have been done in modern surgery. The skin always has upon it bacteria that can cause sores. A boil is a sore caused by certain bacteria that belong to the class of cocci. These get through the skin sometimes and grow and multiply under the skin and form boils.

Killing Bacteria in a Room. — In a room occupied by any one sick of a bacterial disease there will always be present in the air, and on the furniture, floor, and walls, some of the bacteria causing the disease. If others should now occupy the room, they might catch the disease. Therefore, after the sick person is well, the room must be disinfected. To do this a gas that is poisonous to bacteria is introduced into the room. In cities there are men employed by the city whose duty it is to disinfect rooms. They have a machine for making the gas, which is called *formaldehyde*, and they introduce the gas into the room by a little tube passing through the keyhole. All the windows and doors of the room are closed tightly, and all cracks and openings are sealed with paper to keep the gas from escaping. No one is allowed to enter the room for twenty-four hours, because the gas is poisonous to people as well as to bacteria, and because opening a door would allow much of the gas to escape before it has had time to kill the bacteria.

Burning sulphur in a room is another way to kill bacteria. The sulphur should be placed in

an iron vessel, and this set in a pan of water to avoid the danger of setting the room on fire. Four or five pounds of sulphur should be used for a room of ordinary size. A little alcohol may be poured over it to make it burn better. The doors, windows, and cracks should be closed as when formaldehyde gas is used, and no one should enter the room for twenty-four hours.

After the room has been disinfected by the gas, everything in it that is of no value should be burned. The bed clothing and everything that has come in contact with the sick person should be boiled. The floors and furniture should be wiped with the solution of bichloride of mercury that you have learned about. The walls should be scraped and washed over with bichloride of mercury solution, and repapered or freshly whitewashed.

QUESTIONS

1. What effect does bright sunlight have upon bacteria?
2. Why are dark, damp places unhealthful?

3. What are the ways of killing bacteria?
4. What are disinfectants?
5. Why are disinfectants valuable?
6. How should they be used?
7. What is the result of pouring them in the corners of a room?
8. How should they be taken care of?
9. Name the disinfectants mentioned in this chapter.
10. How should carbolic acid be used?
11. How should chloride of lime be used?
12. What precautions should be observed in using a solution of bichloride of mercury?
13. For what is turpentine useful?
14. Why does a cut become sore?
15. What is a boil, and how is it caused?
16. Why should a room be disinfected after it has been occupied by one who has been sick with a bacterial disease?
17. How is a room disinfected?
18. What care should be taken in disinfecting a room?
19. What should be done after the room has been disinfected?

CHAPTER VI

HOW BACTERIA ARE CARRIED

WHEN any one takes a disease that is due to bacteria, it always means that the bacteria have come in some way from some one who has the disease or who recently has had it. Disease-producing bacteria do not live long outside the body.

Direct Contact. — There are various means by which they can be carried from a sick body to a healthy one. If a healthy child should kiss upon the mouth another who has diphtheria, the healthy child would almost certainly catch the disease. The disease is carried directly from one to the other and we speak of this method as *direct contact.*

Indirect Contact. — Direct contact is probably not the most common way by which bacteria pass from one person to another. It is necessary in only a few diseases. More frequently the bacteria travel in the air with the dust, or are carried on things that have been used by the sick one, or have come in contact with him. The dishes,

knives, and forks that he uses could carry the disease to some one else. Hence, any one with a bacterial disease should have his own eating utensils, and these should be scalded with hot water after having been used. Clothing can also carry disease and should never be allowed to come in contact with healthy people until it has been disinfected by one of the means spoken of in the chapter on disinfectants. All such articles are dangerous only when they have the bacteria of disease upon them.

Sputum. — The sputum and discharges from the mouth of some one who has a bacterial disease of the lungs or air passages contain the bacteria of that disease. This material may become dry and ground into powder, and the fine particles float in the air. Should you breathe such air, you are liable to have the disease. Sometimes a person with a disease of the lungs or air passages coughs or sneezes without holding a handkerchief to his mouth or nose. In this way little moist particles get in the air and make the air very dangerous for other people, because the bacteria are in these little moist particles.

Furniture. — The furniture in the room of one who is sick of a bacterial disease nearly always has some of these bacteria upon it, and that is the reason why it is necessary to clean such furniture with one of the disinfectants we have described.

THE FOOT OF A FLY, MAGNIFIED

Food. — Uncooked food may contain the bacteria of disease, and by eating such food we are likely to become sick. If the food has been cooked, and afterward exposed to disease bacteria, it will contain new bacteria and, in spite of the cooking, may convey disease to others.

Flies. — You have probably thought of the house fly as a very innocent creature and may also think that it is impossible to rid ourselves of him. This is not true, however. One of the most frequent ways by which disease bacteria get

upon food is by the common house fly. These little insects often feed upon filth that contains bacteria of disease. Their feet and legs are so constructed as to make them an excellent means for carrying bacteria. They also carry bacteria in their bodies, and may deposit them upon our food. During the Spanish-American War it was shown beyond doubt that the spread of typhoid fever among the soldiers in our camps was due directly to this little pest. Screening doors and windows will prevent the entrance of many flies, but there is a better way than this to deal with them. It has been found that they lay their eggs and raise their young only where there is some filth coming from man or domestic animals, particularly from horses. Now it takes a fly about two weeks to hatch from an

AN UNHEALTHY STABLE

egg and develop into a full-grown fly. This means that if we were to clean often the breeding places of flies, it would be possible to get rid of them entirely. If such places could be kept perfectly clean, one of the greatest causes of disease would be removed. All stables and garbage cans should be cleaned every week. The material that they contain should not be allowed to accumulate, but should be disposed of as soon as possible. A solution of chloride of lime should be sprinkled over all matter that cannot be immediately removed.

Milk and Water. — Milk and water are often the means of carrying diseases to healthy people. Water that comes from a pond or a well, or any water course that has typhoid bacteria in it, will very likely give typhoid to those who drink it. This is the commonest disease carried by water, but there are other diseases that are also due to bad water. If we are not perfectly certain that the water is good, we can make it harmless by boiling it; for, as you have learned, boiling kills bacteria.

Almost all bacteria will grow well in milk. It

affords them an excellent food. For this reason unclean milk is dangerous. There are so many different ways by which bacteria can get into milk, that it is very difficult to keep them out of it. The places where cows are kept and milked should be very clean, and the cows themselves and the hands of the milker should also be very clean. Sometimes disease bacteria get into milk when they are in the water that is used for washing the milk cans or bottles. You have learned that cold prevents the growth of bacteria. That is the reason why milk does not sour so quickly when kept in a cold place. If the bacteria that cause the spoiling of milk are in great numbers in the milk, they may cause disease in any one who drinks it. Milk should be placed on ice as soon as obtained, and kept on ice

A Model Milking Place, Clean and Sweet

until it is used up. We should be very careful that the vessel containing it is clean and has been scalded with hot water. It is not necessary that it should be tightly sealed, but only necessary that it be kept covered.

If we fear that the milk is not free from disease bacteria, we can render it harmless by boiling it, or even by setting bottles of it in water that is boiling hot and leaving them there until the water cools. Such milk is said to be *pasteurized.* The accurate way of pasteurizing milk is to heat it for twenty minutes to 160° F., which is lower than the boiling point; but the treatment with boiling hot water will destroy the bacteria.

The Hands. — Your hands may be the means of carrying bacteria to your mouth, because you often have to touch things that other people touch, and it may happen that some one who has a bacterial disease has touched an article just before you, and so you may get the bacteria of disease on your hands and into your mouth. Now this means that you should keep your hands clean, and be especially careful to wash them before you eat. Your finger nails should be clean, for they may have

disease bacteria under them. You should not put into your mouth your hands, nor anything that is handled very much. Did you ever see any one put a penny into his mouth? That was a very dangerous thing to do because nobody could tell just where that penny had been a little while before, and it might have had disease bacteria on it.

Animals. — Sometimes bacteria pass from a sick person to a well one by animals. A pet cat in the house has sometimes been responsible for carrying diphtheria from one child to another, or even from one house to another. This does not mean that your pet cat must be killed if some one in your house should have diphtheria, but simply that the cat should not be allowed in the room of the one who is sick, for the cat cannot carry bacteria of diphtheria unless he gets them from some one who has the disease.

There is a disease called *bubonic plague* which is fatal and very much dreaded. But we are not so afraid of this disease as we once were, because it has been found that the principal way in which it spreads is by rats. Therefore, the first thing that is done when bubonic plague

starts in a place is to kill all the rats. Think what a task this must be, for you know how many rats there are in almost every town and city. Still, the task has been frequently under-

THE HOME OF THOUSANDS OF INSECTS

taken with success, and the spread of the disease has thus been prevented.

Fleas and other little animals of similar nature are sometimes the carriers of disease. It is the flea of the rat that carries bubonic plague from rats to human beings. There are also other diseases that fleas and similar insects carry from sick people to well ones.

It is not difficult for us to control all these ways by which disease may be carried. By cleanliness of our bodies, clothing, houses, and

yards, and by the proper care of those who are sick, we can do a great deal to prevent diseases.

QUESTIONS

1. What has happened when a person takes a bacterial disease?
2. What is meant by direct contact?
3. What is meant by indirect contact?
4. How should the eating utensils and clothing of one sick with a bacterial disease be cared for?
5. How and when is sputum dangerous?
6. When is the furniture of a sick room a source of danger?
7. What can you say of cooked and uncooked food and bacteria?
8. How do flies carry disease?
9. Where do flies breed?
10. What steps should be taken to destroy them?
11. How can bacteria be destroyed in bad water?
12. What care should be taken to prevent milk from carrying disease?
13. How is milk pasteurized?
14. Why should you keep your hands clean?
15. What animals carry disease?
16. How can we prevent the carrying of disease?

CHAPTER VII

DISEASES THAT ARE "CATCHING"

You have learned something about the nature of bacteria. You have been taught that some of them cause disease. You have also studied the ways in which the bacteria of disease pass from a sick person to a healthy one.

Contagious Diseases. — The diseases that are due to bacteria are commonly spoken of as "catching," because the bacteria that cause them are "caught" by one person from another who has a bacterial disease. They are also called *contagious* and sometimes *communicable diseases*, since one person may communicate them to another. There is another word sometimes used in speaking of these diseases. This word is *infectious*. Any disease that is produced by bacteria or by other invisible germs is called *infectious*.

We know all about the bacteria that cause many of the infectious diseases. We know, for instance, just how the bacteria that cause typhoid fever look. We know what they do

and what they like to eat, and many other things about them. However, we have not yet discovered the bacteria that cause some of the infectious diseases; but we are sure that all infectious diseases are due either to bacteria or to little invisible animals.

A House in Quarantine

Isolation. — Because the bacteria may pass from a person suffering from a contagious disease to a well person, it is important that neither the sick one nor anything that has been near him should come in contact with others. One plan to prevent this is to place him in a room that no one is allowed to enter except the doctor and the nurse. We speak of this as *isolation*, and it means putting a sick person by himself and being careful to do everything that is necessary to

prevent the bacteria of his disease from passing to others.

Quarantine. — Sometimes there are many cases of an infectious disease in a town, city, or even in a whole country. It then becomes necessary to keep the people of such a place from coming in contact with healthy people of other places. When this is done, we say that such a place is *quarantined.*

One Case from Another Case. — Every case of infectious disease comes in some way from another case of the same disease. The bacteria of typhoid fever cannot cause tuberculosis, nor can you catch tuberculosis from some one who has diphtheria. If the bacteria of diphtheria get into dirt, the dirt may give some one diphtheria, but it cannot give him tuberculosis unless the germs of tuberculosis are also in the dirt.

When corn is planted, it is always corn that grows from the seed. If no corn were planted, no corn would grow. Then, too, if the soil were not suited to the corn, it would not grow. So it is with bacteria. They must be planted in the body, and the body must be in a condition suit-

able for their growth. A number of them must enter the body before they can cause disease. If all the corn in the world were destroyed, there would be no more corn. If all the bacteria of disease were destroyed, we should never have any more infectious diseases. A very wise man named Pasteur, who knew a great deal about bacteria, said many years ago that it is possible to make all the bacterial diseases disappear from the earth. Probably we can never hope to do this, but we can destroy many of them.

A Healthy Body. — If your body is in a healthy condition, it may be able to resist the entrance of bacteria, and so prevent disease. You see how important it is that you should keep your body healthy. You should be careful to eat good food, to have plenty of fresh air, and to take enough exercise.

Exposure to cold will make it easier for bacteria successfully to attack the body. You may know that the chilling of the body is often the starting point of pneumonia, which is one of the bacterial diseases. Suitable clothing is, therefore, one means of protecting ourselves against bacteria.

PLENTY OF FRESH AIR AND EXERCISE

When a person is very tired, he is more likely to catch an infectious disease, because great fatigue reduces the strength of the body's defenders and lets the bacteria in.

There is also greater danger of infection if the body has been badly injured. The presence of any other kind of disease makes the body more

liable to infectious diseases, for the strength of the body is then lessened, and the body is not able to resist the attack of bacteria.

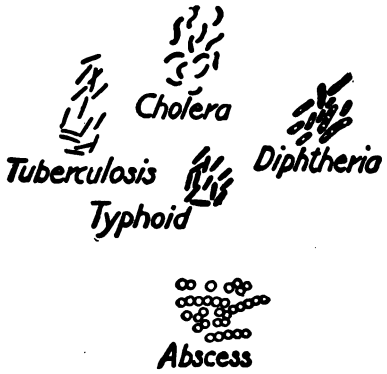
Alcohol lowers the resistance of the body and makes it easier for bacteria to enter and grow. Any other harmful drug will do the same thing. Excessive smoking, especially by young boys, makes the body more liable to bacterial disease.

If any part of the body is weak or diseased, it is more liable to an attack from bacteria than are other healthy parts. When your throat is sore, you are more likely to catch diphtheria than you are at other times.

The cells, like little soldiers, hold the fortress of the body and do battle with the bacteria as soon as the fortress is attacked. If the bacteria enter the fortress, the little cells continue to battle with them. The cells also produce substances in the body that help to kill the bacteria. These defenders of the body, the little cells and the substances they produce, may overcome the bacteria that have entered, and so the body recovers from the disease.

Immunity. — It often happens that the little

defenders of the body become stronger from such a conflict, so that the next time bacteria try to enter, the defenders quickly throw them off. It very rarely happens that any one has measles or whooping cough a second time. When the defenders of the body are strong enough to make the body proof against a certain kind of bacteria, we speak of this as *immunity*. Unfortunately, there are some bacterial diseases that are not followed by immunity.



BACTERIA THAT PRODUCE CERTAIN DISEASES

Bacteria Attack Different Parts of the Body.—Usually one kind of bacteria likes one part of the body better than other parts. The bacteria of diphtheria prefer to attack the throat; the bacteria of typhoid fever usually attack the walls of the intestines; the bacteria of tuberculosis most commonly attack the lungs. All these bacteria may, however, attack other parts of the body.

Bacteria that cause disease of the lungs or air passages usually, but not always, enter with the air that we breathe. Bacteria that cause disease of the intestines usually enter with the food that we eat. Sometimes bacteria get into the body through the skin at some point where it is injured. They may then pass to other parts of the body and cause disease at a point some distance from where they entered.

Poisons Produced by Bacteria. — The effects produced upon the body by bacteria are due to the presence of the bacteria in the body, and also to the poisons that the bacteria make. These poisons are called *toxins* and interfere with the work of the cells of the body.

These toxins circulate in the blood and may attack many of the cells of the body, though some of them seem to prefer certain kinds of cells.

QUESTIONS

1. From what does every case of infectious disease come?
2. What would happen if all bacteria were destroyed?
3. What is one great advantage of a healthy body?
4. How may you have a healthy body?
5. What effect has cold, fatigue, or the presence of disease upon the body?

CHAPTER VIII

TUBERCULOSIS

TUBERCULOSIS is due to bacteria. The bacteria that cause it belong to the class called bacilli. They are tiny rods, and the full name for them is *bacilli of tuberculosis.*

These little rods enter the body in several ways and may attack any part of it. The extent and nature of the disease that they produce depends largely on the part of the body they attack. When they attack the bones, they produce disease of the bones that is different from the disease they produce when they attack the lungs. We use the word tuberculosis to refer to disease of any part of the body that has been attacked by the bacillus of tuberculosis.

The word *consumption*, which is very commonly used, refers only to disease of the lungs, caused by the bacillus of tuberculosis. Now you understand that there may be tuberculosis of any part of the body, and that consumption means tuberculosis only of the lungs.

It has not been very many years since the real cause of tuberculosis was found. The bacillus was discovered in 1882 by Robert Koch, a German scientist. This was one of the greatest of all discoveries, because it made it possible for us to prevent this disease. Before the bacillus was discovered, tuberculosis of each different part of the body was considered a different disease; but after the bacillus was discovered, it was found to be the cause of tuberculosis wherever it appeared.

Tuberculosis is one of the worst diseases we have to deal with, because it is spread all over the world, and causes more deaths than any other. At least one hundred and fifty thousand people die every year from it in the United States. Yet tuberculosis is preventable, and could be made to disappear from the earth, if the sputum of those who have it were properly disinfected. Much has already been done in this direction. Between the years 1887 and 1902 the death rate in New York City decreased forty per cent. That is, at the end of the sixteen years only about one half as many people in that city were dying from tuberculosis as

before. This was because during this time measures had been taken to prevent it.

Tuberculosis not Inherited. — At one time it was thought that children of tubercular parents were born with the disease. We now know that this is not true. It is true that children of tubercular parents are likely to inherit weak bodies, and so make it easier for tuberculosis to attack them. Tuberculosis can also more easily attack them since they come in close contact with their parents at an age when they have the least resistance against the disease. If parents who have tuberculosis of the lungs never kissed their children on the mouth, nor came in very close contact with them and took proper care to disinfect their sputum and to prevent it from getting on their hands and on things around them, the children would probably escape the disease and might grow up to be strong men and women.

Consumption. — Tuberculosis of the lungs, or *consumption*, is the commonest form of the disease, and the bacteria that cause it are nearly always in the sputum of those who have it. If people could be prevented from spitting on the

streets, on the floors of houses, and in other places, or if the sputum of those who have tuberculosis could be disinfected, consumption would disappear. The bacillus of tuberculosis cannot live long outside the body.

When it attacks the lungs and grows in them, it destroys the cells of the lungs, it breaks down the lung substance. The person coughs, and the material that he coughs up contains the bacteria that cause the disease.

Tuberculosis when it attacks the lungs usually enters with the dust in the air that is breathed. No doubt many of us have breathed bacilli of tuberculosis into our lungs at some time during our lives, but either too few bacilli were taken in to cause the disease, or the healthy condition of our bodies prevented us from having it, and the healthy cells that are our defenders destroyed the bacilli. The air in houses occupied by people who have tuberculosis, and who are careless about their sputum, contains the bacilli of tuberculosis. It has sometimes happened that other people moving into such houses have contracted it. In cities it is now the custom to

A Fruit Seller

disinfect a room that has been occupied by one who has tuberculosis.

Food and Tuberculosis. — Sometimes food is responsible for carrying the disease to the body through the digestive tract. This is probably not a very common way. Still infection certainly occurs sometimes through food, and care should be taken that food should not have in it or on it the bacilli of tuberculosis. People who are suffering from tuberculosis should not be engaged in selling food or preparing it for others.

QUESTIONS

1. What is the cause of tuberculosis?
2. How is the word tuberculosis used?
3. To what does the word consumption refer?
4. Why was the discovery of the tuberculosis bacillus a great discovery?
5. How could tuberculosis be made to disappear?

6. Why do children of tubercular parents frequently have tuberculosis?

7. What is the commonest form of tuberculosis?

8. Where are the bacilli found?

9. How do the bacilli enter the body?

10. Why is a house that has been occupied by a tubercular person dangerous?

11. How should food be cared for to prevent tuberculosis?

CHAPTER IX

HOW TUBERCULOSIS CAN BE CONTROLLED

TUBERCULOSIS may attack any organ or part of the body. There may be tuberculosis of the intestines, the kidneys, the bones. No part of the body is proof against it. The whole problem of preventing it depends upon proper care in spitting. Spitting is not good manners, and this is sufficient reason why we should not spit upon the street or in public places or anywhere else, except into a vessel intended for the purpose. A person may have tuberculosis in its early stage without knowing it, and his sputum may contain the bacilli. Hence the rule against spitting should apply to every one, and this is the case in cities where any one who spits in a public place, whether he has tuberculosis or not, is liable to arrest.

The bacilli are in the sputum of a person with the disease. Anything, therefore, is dangerous that comes in contact with the sputum of such a person. Those who have tuberculosis should always spit in some vessel that can be scalded,

or into something that can be burned up. Little paper cups for this purpose can be bought very cheaply. Paper napkins may be used and kept in a paper bag during the day, and burned with the bag at the end of the day. These napkins should always be held over the mouth and nose while the person coughs or sneezes, to prevent the little particles of sputum from flying in the air.

As we know that the bacilli of tuberculosis are with the dust in the air, we should avoid dusty places as much as possible. Dust, however, cannot give tuberculosis, if it does not contain the bacilli, and they cannot get into the dust if the people with tuberculosis do not spit on the street and in other public places. There is also another good reason for avoiding dust. Even if it does not contain the bacilli of tuberculosis, it gets into the lungs and irritates them. The dusting of articles of furniture in a room should be done with a damp cloth. The floors should be dampened before they are swept, and every means taken to prevent "raising a dust." We should always breathe through the nose, because the hairs and moist surfaces of the nose take

up much of the dust and bacteria before they can reach the lungs.

A Consumptive not Dangerous if Careful. — Since the sputum of one who has tuberculosis of the lungs contains the bacilli, and is the means of carrying the disease to others, it follows that one suffering from the disease is dangerous to others only when he fails to take proper care of his sputum. If he is properly careful, he is not dangerous, and there is no reason to be afraid of him, nor any reason why he should not live in the house with others. It is best, however, that he should have a room to himself, and also best for him to have his own eating and drinking utensils. He should also have separate towels, napkins, and toilet articles.

He should be careful to wash his hands and clean his finger nails before eating. He should have plenty of sleep and lie down frequently during the day. He should never kiss any one upon the mouth.

Tuberculosis Curable. — For a long time it was thought that tuberculosis could not be cured, but we know better now. A great many cases have

been cured, and it has always been in the following way. The patient lives in the open air as much as possible and has plenty of sunshine. He sleeps out of doors if possible. There are many

OPEN-AIR TREATMENT OF TUBERCULOSIS

ways of doing this. Tents, specially built cabins, porches, and window attachments have all been used successfully to give the sufferer the benefit of sleeping out of doors. Fresh air, abundance of good food, and regular living are the means of curing

tuberculosis. Even those who have had it for a long time have sometimes been cured, so no case should be considered hopeless.

Medicines and Tuberculosis. — There are no medicines that will cure tuberculosis, though some of them may help. No medicine should be taken by those who have the disease, except by the advice of a physician. All patent medicines should be carefully avoided.

PLAYGROUND FOR CONSUMPTIVE CHILDREN

Hospitals. — There are hospitals at various places in this country where consumptives may go and be sure to obtain the right conditions for being cured. Some states have hospitals where they treat those who are too poor to go to private hospitals.

QUESTIONS

1. What precautions should be taken with tuberculosis?
2. How may tuberculosis be cured?

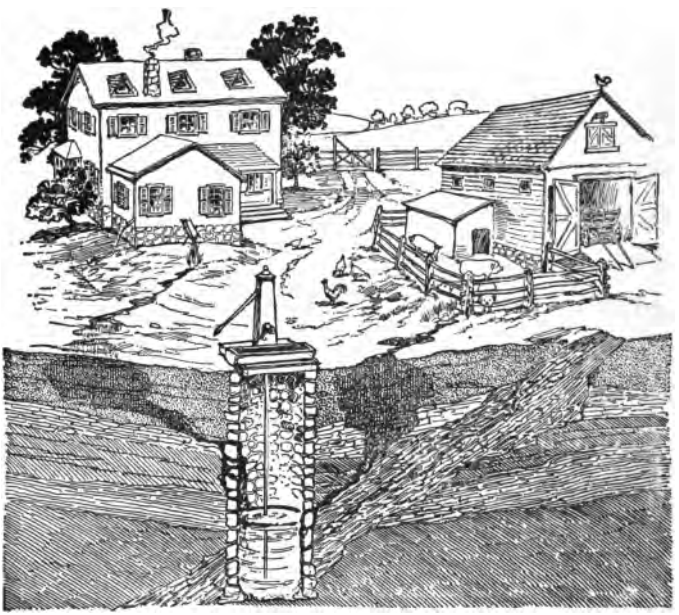
CHAPTER X

TYPHOID FEVER

TYPHOID FEVER is a disease of the small intestines caused by a bacillus that enters the wall of the intestines at certain points and produces ulceration, or sores. It also produces toxins that are taken up by the blood and injure the cells of the body. The bacteria that cause the disease are found principally in the discharges from the bowels and kidneys of one sick with the disease. For this reason, in a case of typhoid fever, the discharges should be very carefully disinfected. The chloride of lime or the carbolic acid solution should be used for this purpose.

Incubation Period. — When the bacilli of typhoid fever enter the body, some days must pass before the disease shows itself. The length of time varies, but averages about fourteen days. This period of time is known as the *incubation period.* All infectious diseases have an incubation period.

Water and Typhoid. — Impure water is probably the most common means of carrying this disease. When we say impure water, we mean impure so



AN UNHEALTHFUL LOCATION FOR A WELL

far as typhoid bacteria are concerned. In order to cause typhoid fever, the water must contain the bacteria that produce the disease. These bacteria can only come from some one who has typhoid fever, or who has recently had it. The bacteria

may get into the water in some way from the discharges of such a person when these discharges have not been disinfected or properly disposed of. Ice from such water will also contain typhoid bacteria. Whenever there are a number of typhoid cases in a place, all water that is used for drinking should be boiled. You have learned that boiling will kill the bacteria.

The Lesson One City Taught. — For a number of years the city of Munich in Germany had no system of sewerage, and during this time the people drank water from wells. The result was that many cases of typhoid fever occurred in the city, because the water of the wells was made impure by sewage containing typhoid bacteria. The city finally put in a sewerage system, and also furnished the people with pure water. As a result of this, the death rate from typhoid fever was seventeen times lower than it had been before these improvements were made.

Food and Typhoid. — Milk often conveys the bacteria of typhoid fever. The bacteria get into the milk from water that is used in washing the milk vessels, or that is added to the milk to

increase its quantity, or from the hands of one who is nursing a typhoid patient. Milk is excellent food for typhoid bacteria, and they grow very rapidly in it. You have been told how to kill bacteria in milk by heating it, and this method should be used whenever we are not certain that the milk is free from typhoid bacteria.

Uncooked food, such as lettuce, salads, and celery, may carry the disease, because the soil from which they come may have had typhoid bacteria thrown upon it in the discharges of one sick with the disease; or such food may have been washed with water containing the bacteria. Flies often bring the bacteria from the discharges of typhoid patients and deposit them upon food.

Prevention of Typhoid.—Remember that it is the discharges of the person sick with typhoid that are dangerous. These discharges should be carefully disinfected with the solution of chloride of lime. This solution should be used abundantly, poured over the discharges, and allowed to act for a considerable time. The patient's bed clothing should be placed in a solution of carbolic acid before it is boiled and washed. The one who nurses

the patient should be careful to wash her hands frequently, and to use a disinfectant on them. The patient should have his own eating utensils, which should be scalded after use. If all these measures are employed, the typhoid patient will not be dangerous to others, because the bacteria of the disease are not in the air that he breathes out, but only in his discharges, and if they are carefully disinfected, the disease will not pass to others.

QUESTIONS

1. Where are typhoid bacteria principally found?
2. How long is the incubation period?
3. What is the most common means of carrying typhoid?
4. What care should be taken with water that may be impure?
5. What was done in Munich to prevent typhoid?
6. What can you say of milk and typhoid?
7. By what other ways may typhoid bacteria be carried?
8. How should the discharges of typhoid patients be treated?
9. Give some other precautions against the spread of typhoid.

CHAPTER XI

DIPHTHERIA

DIPHTHERIA is due to a delicate bacillus that usually attacks the throat, sometimes the nose and larynx. The membrane that is formed is caused by the irritation the bacillus produces. The membrane sometimes closes up the throat, but usually it is not the membrane that is so dangerous. The dangerous thing is the toxin produced by the bacteria. This toxin attacks all the cells of the body, but especially the muscle cells and the nerve cells.

The bacteria are not in the air breathed out by the patient, but they are found in great numbers in his sputum, and in the discharges from the throat, the nose, or the larynx. The bacilli often remain in the throat two weeks or longer after a person is apparently cured of the disease, and it is possible for any one else to catch it from him during that time. Hence, it is a law that a child shall not return to school for some time after the

disease is over. This period of time is usually thirty days after all the symptoms of diphtheria have disappeared.

Infection of others may occur from anything that has been about or near one who is sick with diphtheria. The furniture, carpet, wall paper, or hangings of the sick room, toys, dishes, etc., may all have diphtheria bacteria upon them and carry them to some one else. For this reason there should be as little furniture and as few other articles in the room as possible. The nurse should not come in contact with other members of the household, for her clothing may contain the bacteria of the disease.

Pet animals, particularly cats, often carry infection. They should not be allowed in the room where any one has diphtheria. They should be quarantined and not allowed to run about.

Children who have enlarged tonsils, or throats that are often sore, are more liable to the infection. The same is true of those who have growths in the back of their throats. Such conditions should never be allowed to go untreated.

Incubation Period. — Only a short time passes

after one has been exposed to diphtheria before the disease shows itself. Usually the incubation period is from two to five days.

Immunity. — You have learned that one attack of some of the infectious diseases often results in immunity against the disease. You remember that immunity means that the body is proof against a disease. One attack of diphtheria does not make a person immune against it for very long, possibly for not longer than a few months.

PREPARING THE ANTITOXIN

Antitoxin. — You have been told that when bacteria attack the body, the cells of the body immediately begin to make substances that help to overcome the bacteria. But the cells of the body may not be able to make enough of these substances to overcome the invading bacteria. We can, however, put into the body these substances that have been manufactured in the bodies of other animals. For this purpose we make use of the friendly aid of the horse. The

bacteria of diphtheria or their toxin are put into the horse's body, and the cells of the horse's body immediately begin to manufacture a substance that will overcome the toxin of the bacteria. This substance we call *antitoxin*, meaning *against the toxin*. If we will now take some of this antitoxin from the horse's blood, and put it into the body of a child who has diphtheria, it will help the other defenders of the body to overcome the toxin that the diphtheria bacteria have produced. This is another one of the great discoveries of modern years and has resulted in saving a great many lives. Whenever antitoxin can be obtained, it should always be used as early as possible in a case of diphtheria. It can also be used to prevent others of the household from taking the disease.

The Care of the Sick Room. — The room should be a large one, and plenty of fresh air should be allowed to enter. The floor should be washed up once a day with bichloride of mercury solution. All cloths and clothing used by the patient should be burned if of no value, or soaked in chloride of lime solution. All bits of food left by the patient should be burned, and his eating utensils should

be boiled. No one should be allowed in the room except the doctor and the nurse.

Pouring any kind of disinfectant about the room, or letting it stand in open vessels, will not do any good, but may even be harmful to the patient. When the patient is well, the room and everything it contains should be disinfected with formaldehyde gas, after the manner given for killing bacteria in a room.

QUESTIONS

1. What is it that is so dangerous in diphtheria?
2. How may infection of others take place?
3. What precautions should be taken against the disease?
4. What is antitoxin?
5. What does it do?
6. How should it be used?

CHAPTER XII

PNEUMONIA

PNEUMONIA is an infectious disease due to bacteria that attack the lungs. It is a mistake to suppose that the disease is due to cold. It is true that chilling the body often seems to cause it. However, the chilling simply serves to lower the resistance of the body and to permit the bacteria that cause pneumonia to attack the lungs. When any one is sick with pneumonia, the bacteria of the disease are in the material he coughs up from his lungs.

Pneumonia is a Preventable Disease. — Pneumonia has sometimes been called "the captain of the men of death," because so many people die every year from it. Yet, as it is a bacterial disease, it is preventable.

Pneumonia is Infectious. — Pneumonia is not a very infectious disease, but it has happened frequently that whole families have had it at the same time, one taking it from another. Some-

times a number of people in the same place take the disease, and it has often been shown how it passed from one to another.

Precautions against Pneumonia. — As the bacteria that cause the disease are in the sputum of one

A Hospital Ward

who has it, it is important that his sputum should be disinfected. Other members of the family should not come in close contact with him. Plenty of fresh air and sunlight should be allowed to enter the room. In no disease is fresh air of greater importance.

The bacteria of pneumonia are often found in the mouths of healthy people, and so are ready to attack the lungs should anything happen to lower the resistance of the body. This is one of the good reasons why you should keep your body healthy and your teeth and mouth clean by daily use of a toothbrush and antiseptic mouth wash. Bad teeth afford a good hiding place for bacteria, and bacteria are the principal cause of bad teeth. Teeth that are decayed should be pulled out or filled by a dentist.

Influenza or La Grippe. — La grippe is a disease due to a very tiny bacillus that generally attacks the air passages or the lungs, but may attack the digestive canal or the nervous system. The disease is a dangerous one, because of the bad effects that may follow it.

The bacilli are in the sputum and in the discharges from the nose of one who has the disease in his air passages. Therefore, the most important thing to do in order to prevent its spreading is to disinfect the sputum and the discharges from the nose. Also, whenever it is possible, the patient should be isolated, and should be

kept in bed until he is well. Plenty of fresh air and sunshine should be allowed to enter the room. When the patient is well, the room and everything in it should be disinfected. When there are many cases in any place, those living there should be very careful to keep up their general health and to avoid exposure. Old people are especially liable to the disease, and particular care should be taken to prevent their coming in contact with one who has it.

Colds. — There is no doubt that some colds are infectious. Here, as in pneumonia, the chilling of the body which we usually think of as necessary to produce a cold, only lowers the resistance of the body and makes it possible for the bacteria to get a foothold in the lining of the nose. Close contact with one who has a cold should be avoided, and the secretions of his mouth and nose properly cared for by disinfecting handkerchiefs and towels that he uses.

QUESTIONS

1. How does chilling the body help to cause pneumonia?
2. What precautions should be taken to prevent it?
3. Why is la grippe dangerous?

CHAPTER XIII

DISEASES OF CHILDHOOD

SOME diseases are spoken of as "diseases of childhood," because children very commonly have them, though grown people may have them, too.

Children should be prevented from taking the diseases that are spoken of as diseases of childhood. Some parents make a mistake in allowing their children to have them when it could be prevented. Diseases of childhood are more serious than they are given credit for. They very often lead to other diseases. For example, both whooping cough and measles favor the development of tuberculosis and pneumonia, and scarlet fever and diphtheria favor the development of heart and kidney diseases.

Whooping Cough. — The cause of whooping cough has recently been discovered. It is a short, thick bacillus that attacks the throat and larynx, and is to be found in the material that is coughed up. The bacteria of the disease are very rarely

carried by a third person. Direct contact with one who has whooping cough seems to be necessary. The chance of infection exists as long as any material is coughed up. The bacteria are not in the breath of one who has the disease, but are in the sputum.

ISOLATION

A child who has whooping cough should be isolated from other children, if this is possible, and should not return to school for two weeks after he has stopped coughing. It is very important to protect him from exposure, because his resistance against tuberculosis and pneumonia is low. It is hardly wise to keep a child who has whooping cough in one room. Other children in the house who are liable to infection should go away from home during the time. If this is not possible, they should keep away from the patient by living in a different part of the house.

Mumps. — Mumps is not a dangerous disease, but it is quite painful, and sometimes, though rarely, leads to other diseases. We do not yet know what causes mumps, but we are sure the disease is due to bacteria, because it behaves in many ways just like other bacterial diseases. Whatever the cause is, it affects the glands at the angles of the jaws, and causes these glands to swell and to become painful.

Mumps is not very infectious, and close contact is necessary to transfer it from one to another. Children who have mumps should be kept away from school at least ten days after the swelling has disappeared.

Measles. — Measles is by no means as mild a disease as many people think. In some places where there have been many cases the number of deaths from measles has been greater than the deaths from an equal number of scarlet fever cases. This is because measles makes it possible for other severer diseases to attack the body.

Measles is another one of the infectious diseases, the cause of which is not certainly known; but here, too, for the reasons that have been given, it

is probable that measles is due to bacteria. They are certainly a very active kind, for the disease is highly infectious and spreads rapidly when it has a good start, and when no measures are taken to prevent it. Direct contact is the most common way by which it spreads, but it may be carried by clothing and other articles.

The skin and lining of the eyes, nose, mouth, and air passages become inflamed. The disease is carried by the discharges from the nose and mouth, and when a child with the disease coughs or sneezes, fine particles carrying the germs are thrown into the air, and the breathing in of these fine particles causes the disease in another. In this way a child, who may appear to have only a bad cold, may give the disease to another, even five days before the skin eruption appears.

When a child is taken with measles, he should, if possible, be isolated immediately, and as in all infectious diseases, a physician should be called in. Serious complications are very likely to arise, and these should be carefully watched for. The same methods of preventing the spread of the disease should be employed as with other infec-

tious diseases. Children who have measles should not be allowed to return to school for at least *two* weeks after the appearance of the disease.

Scarlet Fever. — Scarlet fever is an acute, infectious disease. One of the most striking things about it is the eruption that appears upon the skin. The skin becomes very red, and this fact has given the name to the disease. Later on the skin peels off, and the scales from it are the means of carrying the infection to others. The scales may fly in the air or be carried on clothing or other articles, and so spread the disease. Flies can carry it, and should be carefully kept out of the sick room. Milk is sometimes the means of conveying the infection.

We do not know the true cause of scarlet fever, but we are almost sure that it is bacteria.

A person who has scarlet fever should be isolated, and the strictest precautions should be taken against the spread of the disease. Other children should be kept out of the sick room or, if possible, be removed entirely from the house. Careful methods of disinfection in the sick room should be employed, and after the sick one is well,

the room and its contents should be thoroughly disinfected. Means should be employed to prevent the scales from the skin getting into the air and upon articles about the patient. Some kind of mild ointment should be used on the skin for this purpose. The patient should be given a mild antiseptic bath, under the direction of the physician, before being allowed to leave the sick room. The infection of scarlet fever is not easy to stop, and in this way scarlet fever differs somewhat from some of the other infectious diseases. The greatest care must, therefore, be taken to employ most thorough means of disinfection.

Chicken Pox. — Chicken pox is a mild, infectious disease in which little sores appear on the skin. The infectious material is contained in these little sores. The disease is very infectious.

Isolation of one with chicken pox is generally not necessary, but care should be taken to prevent very delicate children from having it. It is probably infectious as long as there are scales on the little sores.

CHAPTER XIV

OTHER PREVENTABLE DISEASES

Smallpox and Vaccination. — Smallpox was at one time the scourge of the earth and killed millions of people. It seems to be due to a very small animal. We do not fear it so much as did our forefathers, because, fortunately, a way to prevent it has been discovered. We call the way to prevent it *vaccination.*

Vaccination means putting into the body a little of the material, or *virus*, obtained from cowpox. This produces a sore at the point where it is introduced, and the virus is taken up by the body. The cells of the body seem to be stimulated by the virus, so that they begin to make substances that will protect the body from smallpox.

Some unthinking people have opposed vaccination. They do not realize what a terrible thing smallpox was before vaccination came into use, nor how terrible it would become if vaccination were stopped.

In Sheffield, England, where they had at one time a great many cases of smallpox, there were fifty times as many deaths among those who had not been vaccinated as there were among those who had taken this precaution.

If every one were properly vaccinated, smallpox would disappear. The immunity that one vaccination gives, often does not seem to last very many years, and the vaccination should be repeated in five years, or whenever smallpox appears. If the body is still immune on account of previous vaccination, a second vaccination will not take.

When smallpox appears in any community, the health officers immediately take charge of the cases and quarantine them, so that others may not take the disease. They also vaccinate those who have not been vaccinated at all, or who have not been vaccinated for a number of years. The law provides that health officers can force people to be vaccinated. This is right, because it protects everybody against smallpox.

Meningitis. — Meningitis is a disease caused by bacteria that attack the brain and the spinal cord. Sometimes many cases of it occur in a

community, and at these times many deaths result from the disease.

Care should be taken to prevent the spread of meningitis by isolating those who have it. The discharges from the nose and the mouth especially seem to carry the bacteria that cause the disease.

Erysipelas. — Erysipelas is a bacterial disease of the skin. The bacteria that cause it are like those that cause boils, and belong to the class of cocci. Erysipelas is a serious disease, because it may attack other parts of the body besides the skin.

Any one with erysipelas should be isolated, and particular care should be taken to bathe the skin with an antiseptic solution. The usual means for preventing the spread of an infectious disease should be employed. After the patient is well, his room and everything in it should be disinfected, because the bacteria seem to remain for a long time on the walls and upon the articles in the room, particularly if the room is dark and damp. A dry, sunny room is the best place for one who has the disease.

Lockjaw. — Lockjaw is caused by a kind of

bacteria found principally in dirt. Before these bacteria can cause lockjaw, they must get under the skin. If you stick a nail into your foot, lockjaw may follow, because the bacteria of lockjaw may be upon the nail. Such a wound closes up quickly and affords excellent conditions for the growth of the lockjaw bacteria. The wound should be opened up immediately and antiseptics used upon it.

Rabies (mad dog bite). — This disease is caused by the bite of an animal that has the disease. There seems little doubt that the real cause of the disease is a little animal in the saliva of an animal sick with the disease. The bite of a mad dog is the commonest way by which it is produced. But other domestic animals, particularly the cat, when suffering with the disease, can give it to people.

The muzzling of dogs, especially in cities, would help very much to prevent rabies. When pet animals are sick, they should be shut up, and should not be handled or petted.

There is a way of curing the disease, but this is difficult to apply, and cannot be used by all

physicians. For this reason there are places, called *Pasteur Institutes*, where those who have been bitten should be sent for treatment. The disease does not show itself immediately after the bite is received, and may not appear for many weeks.

Hook Worm Disease. — There is a curious disease, called *hook worm disease*, that is quite common in some parts of this country. This disease is caused by little worms that get into the intestines and attach themselves to the lining of these organs. The blood of one who has these little worms becomes very thin and poor in quality.

Hook worms and their eggs are in the soil of certain places, and get into the intestines by the various ways whereby such soil may enter the mouth. This is a good reason why you should keep your hands clean.

Then, too, the little worms frequently enter the body through the skin, causing first an inflammation of the skin, called "ground itch."

Pink Eye. — This disease is an inflammation of the thin membrane that covers the eyeballs and the inner surfaces of the lids. It is caused

by a very small bacillus. The disease is infectious and easily passes from one person to another on towels or handkerchiefs, or by the fingers. It is not dangerous to the sight, but is very painful, and makes the eyes weak for some time after.

Trachoma. — This is a very serious infectious disease of the eyes, sometimes called *granular lids.* It may cause partial or even complete blindness. It is probably due to bacteria, though they have not yet been discovered. The disease is quite common and occurs at all ages. The secretion from eyes affected with the disease contains the infectious material. It is passed from diseased eyes to healthy ones by means of towels, napkins, washbasins, and such articles when they are used in common. It has sometimes spread rapidly in schools and asylums, and in other places where people are crowded together and are careless about keeping clean.

Children who have acute disease of the eyes should not be permitted to attend school until their eyes are well, and the danger of giving the disease to others is past.

Cholera. — Cholera is a severe infectious disease, caused by very small bacteria that belong to the class of spirals. These spirals attack the walls of the intestines and produce a toxin that is exceedingly poisonous to the cells in the walls of the intestines, and to other cells of the body.

Cholera is not common in this country, but it is one of the dangers constantly threatening us. It is not common here because our health officers at the ports where vessels from foreign countries enter are always on the lookout for it, and immediately isolate any case.

Water that contains cholera spirals is the usual means by which the disease is carried. Food is another means, and flies are often responsible for carrying it by depositing the bacteria upon food. The bacteria of the disease are found chiefly in the bowel discharges of one who has cholera, and so the most important thing to do to prevent the spread of the disease is properly to disinfect these discharges.

Bubonic Plague. — Bubonic plague is the disease that was known as the "Black Death" in the Middle Ages. It is especially a disease of the

countries of Asia, but has, at various times, been imported into other countries. Only recently it gained entrance into our country along the Pacific Coast, but was stamped out by the health officers of the government. It is an acute, infectious disease caused by a bacillus discovered by a Japanese scientist, named Kitasato, in 1894.

The infection is carried principally by rats, and the fleas of these animals transfer it to man. Therefore, the first thing that is done in stamping out the disease is to destroy the rats, and to clean up the places where they breed.

The importance of cleanliness of the body in preventing infectious diseases is well shown in connection with bubonic plague. It would be almost impossible for any one who bathed twice a day to catch it, even at a time when there were many cases in the neighborhood. It is chiefly through the skin that the bacilli of plague enter the body.

QUESTIONS

1. How may smallpox be prevented?
2. What causes rabies?
3. What means will prevent the spread of cholera?

CHAPTER XV

MALARIA, YELLOW FEVER, AND MOSQUITOES

A Breeding Place for Mosquitoes

Mosquitoes. — One of the greatest discoveries made in late years is that two of the most dreaded diseases of our country are carried by mosquitoes. These two diseases are malaria and yellow fever. Let us stop a moment to recall that certain little animals, too small to be seen with the unaided eye, can cause disease. We know that one of these diseases, malaria, is not due to bacteria, but to a very tiny animal. A mosquito of a certain kind bites a person who has malaria. The little animals that cause

malaria are in the blood of the person bitten. They pass from his blood into the body of the mosquito, and are carried by the mosquito to another person. The little animals that cause malaria, being in the body of such a mosquito, pass from his body into the body of any one whom he may bite. These little animals attack the blood corpuscles of the person bitten, and that person then has malaria.

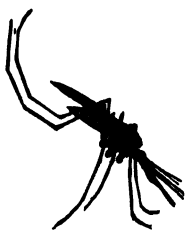
DESTROYING MOSQUITO WRIGGLERS WITH OIL

Destroying Mosquitoes. — We should deal with the moquito very much as we should with the fly. Protecting the rooms of our houses by screens and mosquito netting helps a great deal, but it is far better to destroy the mosquitoes in their breeding places. Mosquitoes breed in stagnant pools of water, or in barrels or tin cans that

contain stale water. Have you ever seen the little wrigglers in a barrel of old rain water? These little wrigglers change into mosquitoes, just as a chrysalis changes into a butterfly. If we could drain all stagnant pools, and not allow water to gather in barrels and other vessels and stay there until it becomes stale, we could prevent the breeding of mosquitoes. The little wrigglers have to come to the surface of the water to breathe. If kerosene is poured on the surface of pools containing the wrigglers, they will die, because the oil will prevent them from breathing. But it is much better to drain all places where mosquitoes may breed.

Yellow Fever. — It has not been shown whether yellow fever is due to bacteria or to a little animal, but it has been shown beyond doubt that yellow fever is carried by a kind of mosquito, and in places where this disease occurs it is only necessary to avoid being bitten by mosquitoes to escape the disease. If we screen the beds of people sick with yellow fever, we shall thus keep the mosquitoes away from them, and the mosquitoes will remain harmless, for they must bite

some one who has yellow fever before they can carry it to some one else. Many of our people worked on the Isthmus of Panama building the Panama Canal. At one time there were many cases of yellow fever there, but after our doctors took charge, yellow fever became almost unknown in that locality. This was because they were careful to prevent mosquitoes from biting the few people who had yellow fever. We can almost say that this simple procedure made it possible for the canal to be built.



A Mosquito Resting

QUESTIONS

1. How is malaria carried?
2. How may the breeding of mosquitoes be prevented?
3. How is yellow fever carried?
4. How may yellow fever be prevented?

CHAPTER XVI

CARE OF THE PUBLIC HEALTH

THERE are many causes of disease that the individual himself cannot control. If he lives in the country, he can see to it that his own well or spring is not made unhealthy by bad drainage, or by having anything in it that would cause disease. But if he lives in a city, he cannot himself attend to the purity of the water supply. This is only one example of a thing that is important to health, but that cannot be controlled by the individual. Therefore, it is necessary that there should be public officers whose duty it is to take care of the public health.

A STREET CLEANER

The police departments of our cities take care

of our property and protect us from criminals. So the health officers protect us from disease.

These officers form what is called a *Health Department*, and to this department is given the power to do what is necessary in preventing disease in the community. In many states there is a state health department made up of the health commissioner and his assistants. In the counties or smaller towns of a state are health boards, which work in harmony with the state department.

The officers of health departments have great powers, and it is right that they should, because the protection of health is a very important matter. Every one ought to assist the health officers in every way possible, because they are working for the good of all. Sometimes the measures used against the spread of disease may seem to be a hardship upon the individual, but he should be willing to bear this for the sake of his family and of others in the community.

Powers of Health Departments. — Health officers have power given them by law to isolate any one who has an infectious disease, or to quarantine a house or an entire community although this may

interfere very much with business, and with other pursuits of individuals. The officers can force people to be vaccinated when smallpox is prevalent. They can place a card on a house stating that there is an infectious disease in the house, and that no one is allowed to enter or to come out. They also have the power to prohibit a dairyman from selling milk that is impure, or that contains great numbers of bacteria; and they have the right to destroy any food that they may find spoiled or adulterated. All public food supplies are under their control, and they can do whatever is necessary to prevent these supplies from becoming the source of disease.

In cities all public places are inspected by officers of the health department, and the owners of these places are required to follow the rules made by the health department for the protection of the public. The health department of a city can also condemn a house that is unhealthful, or prevent the too close crowding of houses and people.

Duties of Health Departments. — It is the duty of the health officers to look after the water

supply of a city or town, and to see that the water is not polluted. They inquire into the causes of disease, particularly when many cases of a disease occur in a locality. It is the duty of the health departments to educate the people in the line of disease prevention. They have charge of disinfection and of all general measures to prevent the spread of disease.

Many departments of health have charge of institutions for the treatment of infectious diseases. They also have laboratories where material is examined to discover the presence of bacteria.

Every One Should Help. — Every one should do his part to help in this work, for it is a noble thing to prevent sickness, suffering, and death. Then, too, in the matter of infectious diseases, you know that keeping others well also helps to keep you well. Every boy and girl should realize that departments of health are laboring to keep people well, and are engaged in a great and successful work in which every one should help.

QUESTIONS

1. Why are departments of health necessary?
2. What powers and duties have the health officers?

GLOSSARY OF TERMS

The Public Health and the Young Citizen

Acute, severe.
Adulterated, made impure.
Antiseptic, a substance that will prevent the growth of bacteria.
Attachment, connection, the means by which one thing is fastened to another.

Consumption, tuberculosis of the lungs.

Decompose, to decay.
Digestive tract, the organs that change the food so that it may be carried to all parts of the body.
Diluted, made thin by mixture with some other liquid.
Disease, sickness.
Disinfected, purified, made free from bacteria.

Garbage, waste material from a kitchen.

Immunity, freedom from disease.
Infectious, "catching."
Inflammation, swelling or soreness, with pain.
Irritation, soreness.
Isolation, the separation of a sick person from others, to preven the spread of a disease.

Laboratories, workshops of scientists.

Ointment, an oily substance.
Organ, a part of the body that performs some special work.

Pasteurize, to heat a liquid for the purpose of making harmless the bacteria contained in it.
Polluted, made impure.
Prevalent, widespread.

Quarantine, the separation of many persons liable to a disease, from others, to prevent the spread of the disease.

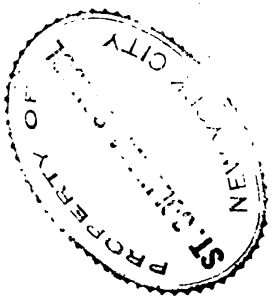
Sewerage, the system of pipes by which a town or city is drained.
Solution, a liquid in which a solid, another liquid, or a gas is dissolved.
Sputum, discharges of the mouth, spit.
Stagnant, impure from want of motion.

Toxin, a poisonous material made by bacteria.
Tubercular, affected by tuberculosis bacilli.

Vaccination, putting into the body material obtained from cow-pox.
Virus, contagious or poisonous matter from the ulcers of cow-pox.

INDEX

The Public Health and the Young Citizen


PROPERTY OF
ST. LOUIS CITY